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ABSTRACT

This source book describes 107 projects administered by the U.S. Department of Education under the Pre-College Teacher Development in Science (PTDS) Program from 1980-82. Under the program, grants of up to $50,000 were made to colleges, universities, and museums to assist them in providing opportunities to elementary teachers for continuing education in mathematics, science, and social sciences. Projects were primarily academic year seminars of summer workshops and seminars. Although projects were subject matter oriented, the emphasis varied from those designed for teachers in need of subject-matter training in the traditional disciplines to those designed to present science subject matter in an interdisciplinary/multidisciplinary mode. Title, name and address of project director, project summary (including goals and objectives), funding year, amount of funding, and discipline(s) are provided for each project. The major intent of this document is to serve as a resource for the planning of future projects based on the federally funded models described. Since elementary teachers have been extremely responsive to these projects, it is hoped that the states will consider providing similar opportunities for the improved teaching of science and mathematics in the elementary school in their jurisdiction. (Author/JN)

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# Source Book of Projects

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# PRE-COLLEGE TEACHER DEVELOPMENT IN SCIENCE PROGRAM

FOR THE CONTINUING EDUCATION OF ELEMENTARY SCHOOL TEACHERS IN MATHEMATICS AND THE NATURAL AND SOCIAL SCIENCES

U.S. DEPARTMENT OF EDUCATION
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This Source Book describes one hundred seven projects administered by the U. S. Department of Education under the Pre-College Teacher Development in Science (PTDS) Program from 1980-82. Under this program, grants of up to $50,000 were made to colleges, universities, and science museums to assist them in providing opportunities to elementary school teachers for continuing education in mathematics and the natural and social sciences. Awards supported projects whose structures were generally academic year seminars or summer workshops and seminars.

The specific objectives of the Pre-College Teacher Development in Science Program have been:

- to improve teachers' knowledge of the subject matter of science.
- to aid teachers in the identification and use of resources appropriate to their level of instruction which will aid in the teaching of scientific concepts, and
- to develop and maintain communication and cooperation between scientists at colleges and universities and teachers in elementary schools.

Projects have been local or regional in orientation, rather than national. This emphasis was intended to promote economy of operation as well as to encourage continuing communication, formal and informal, among teachers who participate and among all teachers in a locality or region.

All projects are subject-matter oriented, although the emphasis varies from those designed for teachers who are in need of subject-matter training in the more traditional disciplines to those designed to present the subject-matter of science in an interdisciplinary or multidisciplinary mode.

The Pre-College Teacher Development in Science Program existed under the auspices of the National Science Foundation for many years. In May of 1980, with the creation of the Department of Education, the component of the program which focuses predominately on the inservice training of teachers at the elementary school level was transferred, for administrative purposes, to the Department of Education. Thirty-nine grants fell into this category.

The first and only year of Education Department funding for the program was in Fiscal Year 1981, when $1.875 million was made available for this purpose. Over two hundred forty proposals were submitted to a group of scientists and educators for competitive review; from these, sixty-eight projects were selected for funding. Fifteen of these grants were what were termed "Bridge Projects," those spanning the middle and secondary school level. The funding for these was shared by NSF and ED, on a formula based upon the proportionate grade levels of the teachers served by the project.

With the passing of the Education Consolidation and Improvement Act of 1981, the PTDS Program, along with approximately 30 other categorical grant programs, was included under Block Grants to the States. Thus, as of Fiscal Year 1982, there is no separate Department of Education appropriation for the inservice

training of elementary school teachers in math and science. Similarly, no National Science Foundation funds were available for the PTDS program for secondary school teachers, due to overall funding cuts in the Science Education Directorate at NSF.

It is therefore the purpose of this Source Book to provide, for the record, a description of the PTDS Program and the projects it has supported under the auspices of the Department of Education, with the hope that it will provide a useful resource for the planning of future projects based upon these Federally funded models. If States choose to use some portion of their Block Grant funding for this method of meeting their teacher training needs in mathematics and science, then this Source Book will provide guidance. It has been our experience that elementary school classroom teachers have been extremely responsive to the projects offered through these college, university, and museum grantees; the elementary school students in their home schools have been the ultimate beneficiaries. We hope the States will consider providing similar opportunities for the improved teaching of science and mathematics in the elementary schools in their jurisdictions.

If you have any questions on a specific project, contact the Project Director listed for that project. For overall program questions, feel free to call this office (202/653-5983).

Kathleen Fulton
Pre-College Teacher Development
in Science Program
Office of Educational Research
and Improvement
Department of Education
Washington, D.C. 20036

# Natural Science Teaching for Fourth, Fifth and Sixth Grade Teachers

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This project was a two-week summer workshop designed to improve science teaching in the 4th, 5th, and 6th grades of Central Alabama by increasing the capabilities of elementary science teachers in the key subjects of their curricula. Twenty-five elementary teachers from public and private schools throughout the target region participated in the program.

Based on the stated needs of local teachers, it was decided that the most useful workshop would briefly deal with the scientific content of a variety of major topics rather than focus on a restricted one, and that local resources, teaching aids, and teaching methods would receive as much emphasis as scientific principles. The fields covered were the human body, ecology, health education, plant and animal biology, weather, earth science, astronomy, light and sound, and electricity and magnetism.

Continued communication and cooperation between participating elementary teachers and the AUM science faculty after the workshop ended has been encouraged by holding the follow-up session to discuss what materials from the workshop work best in the classrooom and by inviting the participants to use the workshop staff as resource persons.

At the conclusion of each workshop day, the elementary science teachers were asked to evaluate the material's relevance to their classrooom needs, value to their own comprehension, and the potential usefulness of teaching methods, projects, and resources covered. At the sessions during the academic year, participants were asked to evaluate the extents to which the various segments of the workshop have proven valuable in classroom applications. The teachers gave extremely enthusiastic evaluations of each of the ten workshop sessions, and almost unanimously found specific experiments, activities, and projects involving direct student participation to be the most useful materials.

Funding Year: 1981
Grant Amount: $14,075*
Disciplines: Biological Sciences, Physical Sciences

* Funded jointly by the National Science Foundation and the Department of Education.

## Topics in Physical Science for Elementary Teachers

Dr. Michael D. Murphy
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The University of Alabama, in cooperation with the seven rural school districts surrounding Tuscaloosa, presented an interdisciplinary course entitled "Topics in Physical Science for Elementary Teachers." The course met on nine alternate Saturdays during the Fall 1981 semester and carried three graduate credits in science which could be applied towards advanced state teacher certification. Thirty-five elementary teachers employed in the seven districts were selected as participants on the basis of their expressed interest, as well as an assessment of need and potential impact as determined by the project staff in collaboration with each district's supervisor of elementary instruction. A pre-session diagnostic workshop was held in June, 1981 and a follow-up meeting in the spring of 1982. Follow-up activities include classroom visits to each teacher during the 1981-82 academic year by one of the project staff members and the district consultant, as well as phone conferences between each participant and the project staff via a WATS line.

The classes were conducted by Dr. Michael Murphy, science educator and chemist, Dr. Gene Byrd, astronomer and physicist and Dr. Joe Benson, earth scientist. Topic treatment, while on the introductory college level, was closely correlated with the specific science books used by the participants in their own classrooms, and laboratory experiences were developed which included the discussion of and practice with complementary lab experiences suitable for use in the participants' own classrooms.

Funding Year: 1981
Grant Amount: $13,455
Discipline: Physical Sciences

A Study of the Ecology and Environment
of Arkansas as
Related to the Elementary School Classroom

Dr. Harold F. Robertson, Jr.
Department of Education
Hendrix College
Conway, Arkansas 72032

The objective of this project is to increase the understanding of elementary teachers in Central Arkansas in the following:

1. The ecology and environment of Arkansas.

2. Related experiments, activities, and content organization in elementary school science for all children.

The core of the project was a two-week lecture-laboratory/field trip experience in August of 1981. In morning classroom/laboratory sessions participants learned the classification systems for and developed an understanding of the plants and animals found in the five physiographic regions of Arkansas. These learnings were reinforced during the afternoon field collecting trips to each of these five areas. Each participant collected specimens to develop a herbarium collection of at least 25 specimens, an insect collection of at least 30 specimens covering at least 7 orders, and learned to identify at least 20 common birds. Ways of relating and applying this knowledge to the elementary classrooom were shown during four halfday sessions on science curriculum organization. The sessions on organizing the science curriculum emphasized reading and science material, the use of commercially prepared science material, material from government agencies such as NASA, meeting the needs of "special" children through science, the place of science fairs in the curriculum, and planning the science unit. The two-week session closed with a work/sharing session that allowed all participants to finish the development of their field collection as workable classroom material. These field collections were used as a basis for the unit of study to be developed and taught by each participant during the fall. School instructional leaders evaluated the instruction during the teaching of these units very positively.

Analysis of the evaluation instrument for the two-week session by an outside evaluator indicates an extremely positive reaction to the workshop. The overall mean score for all responses is 6.5 (out of 7). This same positive reaction to the workshop was expressed by the participants in the oral evaluation session, with the field experiences rated as the highlight of the workshop. Overall, the evaluation indicates that the objectives of the workshop were met.

To date, four follow-up sessions have been conducted. These sessions used the participants' suggestions as guides in meeting the grant's objectives. In the first session questions dealing with the teaching of science to specific "special" children in the participants' classrooms were answered by specialists from the fields of educational psychology, reading, and learning disabilities. The second session centered on the teaching of the environmental concerns of energy and pollution in relation to plants and animals in their natural habitat. The third meeting was a "make-and-take" session for science reading centers and

science reading games. The fourth session was a field trip to Pinnacle Mountain State Park that highlighted the geology of Arkansas and exposed teachers to a new self-teaching field trail.

During January, February, and March, Hendrix's faculty will make on-site visits to each participant's school. Participants have indicated they would like to help structure the visit to meet their needs, in such areas as identification of plants on the school grounds and conducting field trips on or near the school grounds.

Funding Year: 1981
Grant Amount: $27,200
Discipline: Biology

# Training in Mathematics for Elementary School Teachers of the American Indian

Dr. Arthur Steinbrennner
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Tucson, Arizona 85721

The Workshop was conducted, June 2-27, 1980, with courses in arithmetic and geometry, along with a seminar on the teaching aspects. Twenty-eight elementary school teachers attended the Workshop. Twelve were members of a minority group; of the twelve, eight were Native Americans.

The plan for this project arose out of a need to improve the method of teaching a two-semester course in mathematics for the elementary school teaching major, at the University of Arizona. Over a period of years, it appeared that our Native American students had a much lower success rate in the course in question than their Anglo counterparts. Mexican Americans and Blacks also tended to have difficulties with the mathematics. We asked two questions: "Why?" and "What can be done?" The opportunity to try out some ideas arose with the funding of the Workshop.

Accordingly, our major objective was to determine a more effective means to teach elementary mathematics to minority students, in particular, to Native American students. Later the objective was broadended to include Anglos with math anxieties. A program was designed to compare Anglo and minority group achievements and attitudes in a specially designed set of courses.

On the question of differences in learning styles among the various cultures, some interesting observations were made. For example, the Indian student does not respond well to the discovery method of teaching. He/she prefers to regard the learning tasks somewhat independent of time. When the Indian student is ready, then he/she will respond (sometimes weeks later). Another more specific example is one arising out of language differences. In Navajo, there are no words for "greater than" and "less than". These ideas must be expressed indirectly in terms of objects or people. In general, many of the basic mathematical concepts such as seriation, classification, conservation, etc., are not as prominent in the experiences of the Indian child as they are in those of the Anglo child. To find out how adults view one of these concepts, we gave a test on six conservation tasks. The results, which agreed with an earlier study by Dr. Charles Moore of Northern Arizona University, whose test design we used, were: Indian students performed significantly lower (.01 level) than did non-Indian students.

What can be done about the problem? One promising idea was to avoid abstractions in the initial presentations of concepts and processes. Try instead, a laboratory approach--the use of physical materials (manipulatives), to provide a buildup of necessary experiences. Applications--problems in solving examples of mathematics from real life situations, whether from the farmlands of the reservation or from the city newspaper, were presented. These two approaches seemed to provide a common denominator for all students with weak math backgrounds.

Another aspect of the problem of improving learning was that of math anxieties. This malady cuts across cultural lines. Indeed, there was no clear indicator of any differences in affliction between the two groups. Of most help in relieving anxieties was the elimination of formal, written tests. On the positive side, tasks to be performed with the manipulatives proved to be helpful in relieving anxieties as well as to provide necessary background and a way of thinking intuitively and also logically. There was not enough time to explore the process of transference from the concrete to the abstract.

A second summer workshop* (1981), continued the activities with manipulatives and included more problem solving with emphasis on real life applications. The development of sets of appropriate applied problems continues to be a challenge. This challenge is being met in the planning and teaching of our required two-semester course for elementary education majors. The experiences gained in the two workshops have expedited a change in design in these undergraduate courses. Two lecture-discussions and one laboratory session per week is now the mode. Applied problem solving is included. Further, small sections of approximately 20 students have replaced the two large sections of 100 to 150 students.

One measure of success to the new program is the decline in failure rates (down from 10 percent in 1979 to 6 percent in 1980 and 1981). By comparison, the failure rate for intermediate algebra, over the same period, has increased from 20 percent to 35 percent.

No statistically controlled evaluation of the findings from the Workshop was made. However, the participants were asked to fill out a questionnaire at midterm and again at the end of the term. In the final evaluation the participants indicated almost unanimous agreement that workshop experience was beneficial, the objectives were met, the class atmosphere was comfortable, and the courses gave them ideas for teaching and helped to fill gaps in their backgrounds.

A criticism of the program is that the planning did not include an experimental design to help determine if the laboratory approach (use of manipulatives) was more effective with the Indians than with the Anglos, or, in fact, as to whether or not there are other factors to consider. Also, more could have been done with the question of anxieties.

In summary, the objectives, as stated, were met and the impact of the project was felt in the change of design of our University undergraduate course, Modern Elementary Mathematics. Recommendations are (1) that laboratory activities serve as a means of increasing understanding of concepts and processes in arithmetic and basic geometry; (2) that an applied problem solving approach should be the focal point of a course in mathematics for elementary school teachers.

Funding Year: 1980
Grant Amount: $26,795
Discipline: Mathematics

* Funded by the National Science Foundation.

## Integrating Elementary Science with Reading and Mathematics

Dr. Alan Crawford
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The purpose of this project is to increase the amount and quality of science instruction in grades K-6 of the Alhambra, Garvey, Los Angeles Unified and San Gabriel school districts by preparing 30 participant teachers to identify reading and mathematics skills which can be introduced and reinforced as a part of the science program and to provide instruction in those skill areas as a part of science instruction. In this way teachers may give appropriate attention to science instruction without reducing the emphasis that must be given to reading and mathematics under current mandates.

During a four-week summer 1981 session project participants reviewed reading and mathematics continuums from their respective districts and then, using the Elementary Science Study (E.S.S.) curriculum as a vehicle representing many science process curricula, will utilize those skills in preparing instructional strategies. A workshop format was augmented by demonstrations conducted by project staff and by frequent micro-teaching activities. Six school year meetings following the summer session have been utilized to evaluate progress and further develop the integration of science, reading, and mathematics. A number of the teacher participants will then be prepared to train other teachers in these techniques during post-project funding periods.

Project evaluation data will be available in May 1982 and will include pre-and post-project data on number of minutes of science and mathematics instruction per week in participants' classrooms, and pre- and post-test data on identifying reading and mathematics skills which can be introduced or reinforced in the natural and physical science program.

Funding Year: 1981
Grant Amount: $38,027
Disciplines: Biology, Physical Science, Mathematics

## Earthquake Education Project for Elementary School Teachers

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Recent studies have shown that there will be a potentially destructive earthquake in California in the near future. An institute at San Francisco State University was established to implement an educational program in the elementary schools of the Bay Area. We had discovered that little or no earthquake related curriculum was being taught in the schools and that all indications were that it would be enthusiastically received by the teachers because it could, in addition to increasing earthquake awareness, provide an opportunity to strengthen the science curriculum in the classrooom. It was thought that such an approach to earthquake education might provide an exciting and interesting way of learning about science, particularly in the elementary school, where there has been a trend away from science teaching. Moreover, it was hoped that by presenting earthquake awareness at an early stage in the educational development of the students, they would be better prepared to deal with the disruptions that might be expected in a major earthquake.

It was clear at the outset that most elementary schoool teachers lacked a great deal of the necessary academic backgeround in earthquakes and related subjects. This information was provided by the staff of the Institute together with appropriate "hands on" laboratory experiences and field trips to enable the teachers to apply that which they had learned in the classroom.

In addition to subject matter, the staff had to provide and develop the classroom curriculum and materials since none presently existed. The curriculum had to be designed to reflect the variety of achievement levels that could be expected in the elementary schools. Moreover, it had to include materials that were readily available to the teacher and cost low enough to ensure its implementation and continued use in the classrooom. We were very successful at developing these materials and the approach has been utilized in many other programs now emerging in this country and, indeed, in other parts of the world with a similar concern for earthquake education.

Over the past three years, 200 teachers have enrolled in the Institute and are now implementing the program in the schools of the Bay Area. We have continued to supply encouragement and support to these teachers and many have taken a leadership role in the earthquake awareness and preparedness programs in their school districts.

The ultimate evaluation of an earthquake awareness program can be judged by its effectiveness following an actual tremor. The Livermore earthquake of January 1980 provided such a test since the first of a series of moderate tremors occurred while schools of the Bay Area were in session. Teachers from the Institute were teaching in schools close to the epicenter of the earthquake. They played a leadership role in the events associated with the tremor and utilized the earthquake as an exciting and interesting learning experience for the students in their classroom. The unique and successful aspects of this program were widely reported throughout the State.

In conclusion, we feel that the Earthquake Institute at San Francisco State University, funded by the National Science Foundation and the Department of Education, has been a pioneer program in earthquake education. We have demonstrated that teachers and students have a critical role to play in a major earthquake or similar disaster, and we look forward to continuing and expanding our role in this important field, should funding become available.

Funding Year: 1980
Grant Amount: $32,461
Disciplines: Earth Science, Geology

## Science for Teachers of Young Physically Disabled Students (K-4)

Dr. Herbert D. Thier
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Physically disabled youngsters need the benefits that can accrue from hands-on, materials-centered science experiences. This project is training 68 Bay Area teachers who work with mainstreamed or self-contained classrooms of elementary physically disabled students in the content and methods of science and the opportunities to integrate the fundamental skills of language, computation, and everyday living into a comprehensive science program.

Materials and methods for teaching science to disabled youngsters are now available. The SAVI/SELPH program, developed at the Center for Multisensory Learning, Lawrence Hall of Science, provides excellent science materials and teaching approaches that are appropriate for use by visually impaired, orthopedically handicapped, hearing impaired and learning disabled youngsters learning in mainstream or self-contained settings. The nine content areas (modules) of the SAVI/SELPH program form the structure for the training sessions.

The project includes ten 6-hour training sessions for a total of 60 contact hours. The first two sessions occurred in August, 1981, before the beginning of the school year. The 8 remaining sessions take place once a month, October through May, from 3:30-9:30 p.m. on a school day. Release time is not necessary in most cases. Teams of teachers from both special and regular education were encouraged to apply, and did. The result is that groups of teachers are working together to develop a science program not only for their own classrooms, but for the school as a whole.

Each session focuses on the content area of one of the nine SAVI/SELPH modules, and in addition has a process or application theme. The session titles include:

1. Introduction to the Multisensory Approach; Scientific Reasoning Module
2. Life Science in the Classroom; Structures of Life Module
3. Metrics and Standards Units; Measurement Module
4. Language and Communication--the Physics of Sound; Communication Module
5. Science Content and Process; Magnetism and Electricity Module
6. Cognitive Development; Mixtures and Solutions Module
7. An Ecological Perspective; Environments Module
8. Practical Applications; Kitchen Interactions Module
9. Taking Science Out-of-doors; Environmental Energy Module

During sessions, participating teachers have direct experiences with the activities in order to learn the science content, become familiar with the science tools and better understand the processes they will use to teach their own students. During the year, teachers are required to teach activities themselves in science learning centers they set up in their own classrooms.

Teachers receive a number of written resources, including all 40 of the SAVI/SELPH activities folios as models of good science activities for physically handicapped students. For the first five sessions, teachers receive student materials for one science activity (enough for up to 8 students to use at one time) and are encouraged to use the materials with students. They are expected to verbally share the outcomes of the science activities during the following training session. These informal discussions are extremely helpful to the teachers as they can share successes and failures, and discuss problems with each other to arrive at solutions. These discussions also give us an indication of what science is taking place in the classroom and illustrate growth in the teachers' skills over time.

In January (mid course), a science materials lending library will be available to the teachers. Individual teachers or teams of teachers can check out entire modules of SAVI/SELPH activities for a month's time to use in their classrooms. By this time in the course, the teachers are anxious to incorporate more and more science into their overall program. Having a sequence of 4-6 activities on one topic and 4 months of training behind them gives the teachers the resources and confidence they need to be eager and competent science instructors. Teachers are required to complete Activity Log Sheets and End of Module Questionnaires on their classroom experiences with the modules. In addition, project staff visit the teachers, at their request, to observe and consult with them relative to the establishment and operation of the science program in their class or school.

An attitude questionnaire was administered to participants at the beginning of the program and will be administered again at the end of the program. The questionnaire emphasizes topics such as desire to teach science, attitudes towards setting up learning centers in the classroom, and working with physically handicapped children in science as well as the importance of having a material-centered science program in class.

Most of the direct instruction is provided by the two senior project staff members with occasional guest lectures by University of California professors and other Lawrence Hall of Science staff. The two staff members are available all year as science consultants to participating teachers. A lasting relationship between the participating teachers, their schools and the Lawrence Hall of Science is established.

This is the second year we have offered a course of this type, but the first year for early elementary grade teachers. The format of the training sessions is highly successful. Teachers feel that science is exciting, even fun, and see opportunities for interdisciplinary instruction. Their fears of teaching science are set aside as they internalize science teaching over a 9-month inservice period. The sustained support from the Lawrence Hall of Science staff members both in the form of consultation and materials is the key to the success of the program.

Funding Year: 1981
Grant Amount: $49,756
Discipline: Interdisciplinary (for Physically Disabled)

## Science Fundamentals Through Activities

### Astronomy, Biology, and Energy

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This project consists of a ten-session course designed for forty upper-elementary and intermediate school teachers who need to strengthen their knowledge and teaching skills in the fundamentals of science. They received a total of ninety-two contact hours each. The participants, assisted by the Lawrence Hall of Science staff, conducted five one-day (6-hour) inservice workshops for one hundred local teachers.

The program assumes no previous background in science, and provides a thorough understanding of the experimental approach to science teaching through simple, hands-on activities in three areas of high student interest and motivation: astronomy, biology, and energy. The choice of these diverse subjects promotes observation by the participants of the common features of the sciences studied and leads to discussion and understanding of the fundamental concepts of experimental design, data analysis, and theory formation. A handbook was assembled describing the existing 90-hour workshop curricula and successful supplemental curricula to reinforce the participant's teaching efforts. Also noted were the staff of the Lawrence Hall of Science available for inservice training for science teachers and their potential as science resources for teachers. Participants in the program will be able to teach classes to their own students using the Lawrence Hall of Science Biology Lab and Astronomy/Physics facilities.

The program is designed to expand the availability of our previous NSF-sponsored workshops, since similar workshops, offered in the academic years 1977-78, 1978-79 and 1980-81, were oversubscribed. The present format encouraged participation by teachers outside of the nine Bay Area counties and by teachers who were unable to take the earlier courses because of time conflicts.

Funding Year: 1981
Grant Amount: $39,498*
Disciplines: Astronomy, Biology, Energy

* Funded jointly by the National Science Foundation and the Department of Education.

## Science for Elementary School Teachers

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This project was designed to meet the needs of K-6 teachers and their supervisors as demonstrated in their responses to a large scale needs assessment. Both master and beginning teachers were surveyed and assessments of their immediate and long-range needs were used in developing this program. The Science Supervisors of the Denver Metropolitan area, in conjunction with local precollege and college teachers, are directly responsible for the syllabi to meet these expressed needs.

The programs are designed to strengthen science education in the Denver Metropolitan area by:

a. providing K-6 teachers with increased science subject matter knowledge in selected areas of life, physical and earth sciences;

b. providing K-6 teachers with experimental experience to reduce the "anxiety syndrome" often encountered in the scientifically unsophisticated elementary teacher;

c. providing adequate instruction to enable transfer of the course material within the K-6 classroom;

d. providing examples as well as instruction on classroom safety;

e. providing increased knowledge of local resources which can be used in science instruction;

f. providing elementary school teachers with an increased awareness of the human resources available to them to assist with their classroom performance, particularly that available at the school district and college/university level; and

g. providing avenues for continuing professional relationships between teachers at all levels.

These objectives are accomplished by offering eight "mini-courses" to K-6 teachers. Each mini-course is approximately 18 classroom hours, generally 3 hours per week for six weeks. (This type of program has proven to be very successful; almost 100% of those surveyed agreed that the mini-course format is preferrable to the usual quarter or semester term for inservice courses.) Each course is staffed by a college level master teacher and two classroom master teachers. The college teacher is primarily responsible for science content and for course organization, while the two precollege classroom teachers are responsible for the content by the introduction of "hands-on" methods of classroom introduction. The personal contact in the 10:1 student-staff ratio encourages the humanization of science, hopefully overcoming the "science anxiety" often experienced by unprepared teachers.

The courses offered include three courses in Physical Science (Light and Optics, Electricity and Magnetism, and Heat and Temperature), three in Life Science (Plants and Animals, The Use of the Zoo as a Science Laboratory, and Plants and Animals of Colorado), a course in the Geology of the Front Range of the Rocky Mountains, and a course in Energy Resources.

The Physical Science courses each met for three evening hours once a week for six weeks. The Zoological Laboratory course met two evenings plus two Saturdays. The Plants and Animals course met four consecutive Saturdays. The first two Saturday sessions were held at the Denver Botanical Gardens and the last two at the Denver Museum of Natural History. The Front Range Geology course met in six half day sessions with the last four as field trips. The Energy and Resources course followed the six evening format.

The use of the Zoo, Botanic Gardens and Museum of Natural History offered exceptional strengths to these programs. The courses were largely taught by the professional scientists staffing these facilities, and coordinated by two highly qualified science teacher-supervisors. At these facilities, the teacher-participants were introduced to the basics of science and also given "behind the scenes" looks at the intricacies and real scientific studies which go into the production of the public exhibits. In addition, their questions and comments often led to significant changes in the exhibits since these teachers often comment from the "lay" position.

The physical science courses were chosen to increase knowledge in the usually less studied areas (E & M, Light and Thermo.), particularly emphasizing the "hands-on" approach to science. Our experience shows that many teachers don't do experiements in their classrooms simply because they don't know how! The age group being served here (K-6) learns by experience. Lectures are usually not understood unless the child wants a question answered and teachers are reluctant to perform an unfamiliar (to them) experiment in the classroom. The Plant, Animals and Safety in the Classroom course was conducted in much the same vein. The field Geology course was designed for those with very limited geological background so that it could be an explanatory elementary course. Local features which can serve as classroom aids or examples were the central focus. Four of the six sessions were field work with only two classroom sessions.

A total of 204 teachers were served by these courses in the 1980-81 academic year. An evaluation of this project, made via written comments by project faculty, teacher participants, visitation interviews and field observations, indicated that the overwhelming majority of participants found that the project was presented to them in a helpful, understandable manner, and it would be useful to them in their teaching. In addition, a number of recommendations for future activities were made in this evaluation.

Funding Year: 1980
Grant Amount: $45,009
Disciplines: Physical Sciences, Life Sciences, Geology

## Mathematics Through Activities and Models

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This project had two grants, one for an intensive summer session that ran four hours a day for twenty days from June 16-July 15, 1980, and another for an academic year session that was conducted in 26 weekly sessions during the 1980-81 academic year. Two all-day Saturday sessions, one in December 1980 and another in May 1981, were also part of the grants.

It has been the experience of the instructors of this project that the majority of teachers of mathematics (who do not have a major or minor in mathematics) have considerable anxiety about mathematics. They tend to avoid mathematics courses and tend to resist being taught mathematics in the customary modes. However, they are highly motivated to seek out "recipes" for teaching mathematics. This motivation was used as a vehicle to teach a considerable amount of mathematics in this project. The procedure is as follows: mathematically correct concrete models and calculator or computer-based activities for nearly every mathematics topic covered in grades K-9 were collected or constructed, These models and activities were field tested to determine their effectiveness with children both for new and remediation instruction. These models were then used to introduce each topic in the project. As the model was demonstrated as an effective method to teach the mathematics topics in question, the underlying mathematics were then taught. Participants willingly studied the large quantity of mathematics "bootlegged" into the methods presentation, without the usual anxiety and resistance found in traditional mathematics instruction. Furthermore, the teachers learned both an effective method and its underlying mathematics foundation. Upon returning to the classroom, the participants were found to teach mathematics better and with increased enthusiasm.

For the K-4 component, the emphasis was on demonstrating how the models could be used to teach new concepts in the corresponding grade levels. For the 5-9 component, a substantial part of the instruction emphasized how the models could be used in remediation instruction.

In all components, participants were instructed in the use of hand-held calculators, the programming of computers, machine-assisted problem solving, and general techniques of problem solving. Participants in both components expressed delight at how much gain in mathematics knowledge they had achieved through the use of modeling.

Rather than treat geometric topics and measurement as separate entities, these were fully integrated. For example, before metric linear measure was studied, the geometric notions of segments and segment congruence were investigated. Tracing paper, compasses, and MIRA's were used to teach the geometric concepts and also demonstrate mathematically sound concrete methods of teaching these topics. Following this geometry

instruction, the notions of length measure and distance measure were developed using metric units. Laboratory hands-on activities were used extensively throughout the instruction.

One innovative feature was the peer-pairing of participants, to help develop and/or increase each participant's ability to function as a peer mathematics resource person in his or her school. It was also used to help participants learn to talk "mathematics" with one another. In each class, the participants were initially separated into pairs from similar grade levels with "mathematically better prepared" and "mathematically less prepared" participants assigned to work together. In selected aspects of the presentation, the "better prepared" participant acted as a peer teacher to help speed and enrich the instruction for the peer-partner. It was discovered that the peer-pairings had to be changed periodically for the most effective use of this process, as the participants welcomed the experience of working with three or four different partners.

Since the conclusion of the project, the project director has received many requests from the participants to assist with participant initiated workshops and demonstrations. This indicates that there is a very encouraging multiplier effect developing.

Funding Year: 1980
Grant Amount: $21,199 (Summer Project); $30,246 (Academic Year Project)
Discipline: Mathematics

## Physical Science for K-4th Grade Teachers from Central Florida

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Thirty-five K-4th grade elementary school teachers who had a minimal background in Physical Science participated in a four-week Physical Science activity-oriented program at the University of Central Florida from July 13-August 7, 1981. The program was designed to:

1. provide the participants with direct experience with physical phenomena which can be observed with inexpensive materials;

2. provide the participants with direct experience using the LOGO computer language on a microcomputer;

3. demonstrate to the teachers physical science concepts which are found in various elementary schools;

4. show how science activities can be integrated into reading, language arts, social sciences and arithmetic; and

5. help the teachers plan their science activities in their home schools for the coming year.

The 8:30-3:30 daily program consisted of laboratory activities and discussion, work with existing science curricula materials, and the development of classroom learning centers. In addition, each participant received 4 1/2 hours experience on a microcomputer using the LOGO computer language. The group also took two field trips: to the NASA facilities at Cape Kennedy, and to the Martin Marietta Aerospace Company.

Participant response to the sessions was extremely positive, with 91 percent indicating that, based on their experiences with the course, they will significantly change their approach to teaching science next year, and would recommend the course to a friend. Pre and post test performance revealed gains in positive attitudes toward teaching science. The project staff (who were university associate professors in the departments of physics, science education, and elementary education; and two physics teachers, one from a junior high and one from a senior high school) were delighted with the response of the primary grade teachers to this Physical Science Project that was patterned after projects previously used with upper elementary and middle school teachers.

Funding Year: 1981
Grant Amount: $36,559
Disciplines: Physical Science, Computers

## Economics for Elementary Teachers

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This two-week economics workshop conducted in August, 1980, on the campus of the University of West Florida, was designed to serve two primary purposes: first, to help elementary teachers recognize and understand basic economic concepts and the workings of the American enterprise system; and, second, to give participating teachers materials and methods for including economics in their own classrooms. A secondary goal of the workshop was to encourage participants to implement instruction in economics in their own individual classrooms during the 1980-81 school year.

Through lecture and classroom activities, participants were introduced to the principles of economics. A variety of field trips were scheduled to demonstrate application of those economic principles in the business world. Finally, teachers were given opportunities to adapt and develop materials for use in teaching economic concepts to students in their own classrooms in the coming school year.

Improvement from pre- to post-test scores on the Test of Economic Literacy developed by the Joint Council on Economic Education indicates that the teachers did strengthen their ability to recognize and understand economic terms and concepts. The pre-test mean score was 59.1%; the post-test score was 81.2%. This 37% improvement score compares favorably with the performance of similar groups elsewhere. A 25% improvement is closer to the norm.

A follow up one-day workshop in February, 1981, reunited participants from this and previous elementary economic workshops. Teachers shared methods and materials used to teach economics in their own classrooms. Discussions with the participants indicate that most of them included several economic topics in their curricula during the 1980-81 school year.

Funding Year: 1980
Grant Amount: $13,793
Discipline: Economics

## Economic Concepts and Applications for Elementary Teachers of North Georgia

Dr. Elmer Williams
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Selected elementary teachers from public and private school systems of North Georgia participated in an in-depth economic education institute during the 1980-1981 academic year. The institute's major objectives were to (1) increase participants' knowledge of basic economic concepts appropriate for early elementary school instruction and (2) extend participants' ability to identify and develop instructional materials and methodologies for teaching economics to young children.

Economic education instruction was concentrated in a thirteen-week period (Saturdays) during which teachers learned economic content, analyzed materials and methodologies and began development of an innovative instructional program for teaching economics to elementary school students. The original conceptualization of the institute proposed that participants develop a bibliographic guide of teaching resources for economic education in the elementary school to be published by the University of Georgia Center for Economic Education. Early in the project teachers expressed a view that this undertaking was "not challenging enough"; what they really wanted to do was construct a hands-on, experiential instructional program for classroom use. Given teachers' interest in classroom materials development and the magnitude of such a project, the design of the institute was altered to provide the necessary time for the completion of such publishable teaching materials. The project staff decided that if this was to be "the teachers' project" they would be given major decision-making responsibilities concerning the conceptualization, design and development of the materials rather than the usual mode of teaching staff "telling" students what to do and how to do it; thus the term, "teacher-developed," would actually describe the materials.

Results of the project indicate that the proposed objectives were very successfully completed. Project staff decided that a relatively new cooperative teaching/learning strategy, "teams-games-tournaments," developed at John Hopkins University would be utilized to teach economics to the participating teachers. On the standardized economics test, Test of Economic Literacy, developed by the Joint Council on Economic Education, participants achieved a mean gain score of 10.95 (Pre-test mean score of 26.23; post-test mean score of 37.18 on a test composed of 46 items). This mean gain score is over 50% higher than the mean gain score of comparable groups from the recent past which were taught economics using traditional, "lecture-oriented" techniques. These very favorable cognitive gain results encouraged the project staff to submit a complete description of the institute to the 1980-1981 National Awards Contest for Excellence in the Teaching of Economics sponsored annually by the Joint Council on Economic Education and the International Paper Company Foundation. In the spring of 1981 the project staff was notified that the entry had won third place in the college and university division. Another outcome of the institute has been that the teaching

assistant of the project is now in the process of conducting the first controlled experiment in the use of "teams-games-tournaments" to teach social science content to college students as the basis of her doctoral dissertation.

Classroom teaching materials developed by participants were extremely innovative, using puppetry and music as major elements to teach economics to young children. Materials are presently being revised and edited for publication by the Center of Economic Education in the near future. Selected teachers of the institute were invited to present a session describing the development of the materials at the annual meeting of the Georgia Council for the Social Sciences in October of 1981. Response from methods instructors and other classroom teachers attending this session indicated a large interest in the completed instructional materials. It is expected that the instructional program will be available in the spring or summer of 1982. Copies will be sent to the 49 state councils on economic education and the 250+ university centers for economic education which make up the national network of the Joint Council on Economic Education. The 800+ cooperating school systems of this national network will also be informed of the availability of the materials.

Funding Year: 1980
Grant Amount: $28,850
Discipline: Economics

## Political Science/Citizenship Education for Teachers of Early Elementary Grades

Dr. Mary A. Hepburn
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Twenty-nine elementary teachers of grades kindergarten through four participated in this citizenship education course that was held for four days in August 1981 followed by seven evening meetings in the fall of 1981. Two to four teachers from each of 13 schools were recruited so that they might work as a team when they returned to school in the fall. This project was initiated because so few early elementary grades teachers have studied fundamentals of American government and political science in their college education, and, consequently, they fail to teach basic concepts of citizenship in early elementary grades where research clearly indicates that a strong foundation should be laid.

The project was designed to: 1) demonstrate the importance and feasibility of teaching political concepts and basic skills as part of the early citizenship education of elementary students; 2) increase teacher knowledge of fundamental political science concepts and information sources; 3) expand teacher experience and teaching perspectives by utilizing a variety of home, community and media resources in concrete learning activities adaptable to the early elementary grades; 4) include the teachers in a statewide educational system which updates their political information and provides for an exchange of recommended teaching strategies via a teacher newsletter.

Instruction was of four types: 1) lecture-discussions with political science and social science educators; 2) face-to-face meetings with public officials and other community resource persons; 3) teaching demonstrations and follow-up discussions; and 4) field learning experiences. Among the session topics were:

Kinds of Taxes - Paying for Government Services

Teaching Democratic Responsibility in the Classroom

What are Courts - American Judicial Principles

Teaching Math Skills in Citizenship Education

Teaching Locational Concepts and Map Skills

Teaching Citizenship Concepts in Reading and Literature

Law Enforcement Services - Tour and Discussion at City Police Department

Effects of projects were evaluated by: 1) pretests and posttests of political/citizenship knowledge and attitudes toward the subject; 2) observation of teachers applying what they have learned in their own classes; 3) required projects turned

in at end of course - 4 teaching displays or presentations to teach political concepts, and 4 lesson plans; and 4) Project Rating Sheets on which participants rated sessions, content, and overall program at the end of the project.

The teachers were tested before the course began in early August and at the end of the course four months later in December. Two previously validated instruments were used:

1. The Citizenship Knowledge Test - a/
2. The Attitude Toward the Subject of Political Education Test - b/

Citizenship Education for Early Elementary Grades Test Results

| Test | Highest Possible Score | Pretest | | Posttest | | T Value |
|---|---|---|---|---|---|---|
| | | Mean | S.D. | Mean | S.D. | |
| Knowledge Test | 73 | 50.6 | 12.07 | 57.8 | 8.15 | 5.47* |
| Attitude Test | 4 | .098 | 2.34 | 2.09 | 2.07 | 3.99* |

*p [.001

Observation data collected during the last two weeks of the project supported the high level of significant improvement indicated by the test data. Each teacher was observed teaching her class one of the lessons she had planned. Games, bulletin boards, learning centers, and other teaching materials which were seen in the classrooms indicated that the teachers had adapted many of the ideas and materials presented in the course. Teaching activities also revealed that many of the teachers had learned useful information about local, state and national government and the fundamental principles of American politics. Likewise there were indications of broadened global perspectives and increased political awareness.

On the rating sheets teachers rated most sessions very highly and expressed great appreciation for an opportunity to take a course which strengthened an otherwise weak area in their own education. A summary of the rating sheet data is available.

An additional benefit to the teachers is their becoming members of the Teaching Georgia Government network; they will receive this newsletter which updates political science and citizenship education information for teachers throughout the state and provides for an exchange of ideas on teaching strategies.

a/ Seventy-three item test with reported KR21 reliability of .92. (See Test Manual for the Citizenship Knowledge Test by Napier, et. al, 1981, University of Georgia, for norms, validity and reliability.)

b/ Based on J. Hand's Scale to Study Attitudes Toward College Courses - 45 item test with reported split half reliability ot .92. (See Shaw and Wright, Scales for the Measurement of Attitudes. McGraw-Hill, 1967.)

Funding Year: 1981
Grant Amount: $18,954
Discipline: Political Science

## Principles of Physics for Teachers

Dr. Arnold Feldman
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The purpose of the project was to teach physics to elementary and junior high school teachers in order to raise their competence in the subject and to increase their confidence so that they would be more likely to teach physics to their students. The course offered in 1980-81 was similar to that conducted under a previous NSF Pre-College Teacher Development in Science grant in 1979-80.

The course offered was a three-credit tuition-free course, Physics 503, entitled "Principles of Physics for Teachers." The topics covered were rectilinear motion, Newton's Laws of Motion, kinetic and potential energy, heat and thermodynamics (First and Second Law), wave motion and sound, optics, atomic and nuclear physics. The course offering was advertised through a circular sent to the principal of each elementary and junior high school in the state. The principals in turn alerted their teachers to the offering.

Classes met on five alternate Saturdays in the fall (1980) on Oahu and Hawaii and similarly in the spring (1981) on Maui and Kauai. The participants received 45 hours of instruction. During each session there was a lecture plus laboratory exercises in which the entire class participated. The laboratory experience reinforced and supplemented the ideas presented in lecture. The exercises were done using supplies purchased locally, whenever possible, or obtained from scientific supply houses. Participants took home the materials used in the exercises and were encouraged to introduce them into their classrooms.

The structure and operation of the course provided several advantages to the teachers:

A) They had direct and immediate experience with the ideas presented in lecture. This "hands-on" approach reinforced learning.

B) They used simple inexpensive supplies, much of it purchased locally. This tended to "demystify" physics because they could see the construction of each set-up. There were no "black boxes."

C) Each laboratory exercise stressed one or more principle of physics. Part or all of an exercise could be used in their classrooms, with suitable modification for different grade levels.

The impact of the project on its participants was assessed in several ways:

A) To successfully complete the course, each teacher had to use several exercises in his or her classroom and submit a written

report describing the activities and asessing student reaction. These reports were returned to the participants, with comments, for their use.

B) At the conclusion of the course each participant filled out an anonymous course and instructor evaluation form which was mailed in to the Academic Evaluation Office where the responses were tabulated by computer and compared to campus-wide norms.

C) The teachers who completed the course in 1979-80 were surveyed at six-month and one-year intervals, to assess the project's long-term input. The response, though too small to be statistically significant, showed half of these respondents to be teaching more physics in their classroom as a result of the course.

All sixty-two teachers who enrolled in the course completed it.

Funding Year: 1980
Grant Amount: $15,453
Discipline: Physics

## Teaching Elementary Science With Inexpensive Experiments

Dr. Alfred M. McGlinsky
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The objective of this project is to increase the number of hours local elementary students spend doing direct experimentation in the sciences, as contrasted with hours spent reading about science, through systematic dealings with the attitudes, knowledge base and the teaching techniques of elementary science teachers. A reference collection of ideas using readily available, inexpensive materials was developed and utilized as a basis for acquainting teachers, and through them, their students, with experiment-based approaches to science, its concepts and its methods.

The project is organized around a four-week summer workshop, followed by eight monthly meetings at host schools during the academic year. The participants were thirty teachers of grades two through seven. It was found that starting the summer project with one week in residence in an outdoor setting, away from the demands of home, produced great pay offs. The participant group became closely knit, facilitating the sharing of good ideas, removing barriers to examining new teaching techniques, and eliminating tendencies to hide deficiences the teachers knew to exist in their past science preparation and science teaching programs. The week in residence was followed by three weeks of commuting to the on-campus workshop. Evaluations of this part of the program indicate that the participants came away with a tremendous enthusiasm for teaching science, based on their new understanding of methods of teaching hands-on science. The monthly sessions during the academic year have also been productive, with participants supporting each others' efforts and sharing ideas, and the impact noted and valued by the school administrations where the participants teach.

A final assessment of the project will be made in June, based on a comparison of the actual amount of time each participant has spent teaching science, especially hands-on science, compared to that spent the year before the project's intervention.

Funding Year: 1981
Grant Amount: $26,429*
Discipline: Interdisciplinary

* Funded jointly by the National Science Foundation and the Department of Education.

## Bradley University Field-Science Projects

Dr. Steve Permuth
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The purposes of the four week summer workshops have been to 1) increase the participants' knowledge and identification of resources in geology/biology as it pertains to field-science and 2) to provide a program of cooperation between college scientists, college educators and elementary school teachers for the thirty participants (grades K-8) selected from the sixteen county areas surrounding and including Peoria, Illinois.

To accomplish these broad aims, the program had a "base" at three primary sites (Bradley University, Sun Foundation Nature Area, Marshall County Conservation Area) and emphasized extensive "hands-on" field experience utilizing and emphasizing the strong subject matter presentation of the staff. Activities to assess content accumulation included the identification, interpretation and use of commonly encountered objects and phenomena (rocks, plants, animals) in a variety of sites (vacant lots/forests), and introduction to field and lab techniques for elementary class use (thin sections and peels to study fossils, parabolic reflectors to study bird vocalizations), and the development of materials for participants' elementary classrooms (rocks, fossils, photographs, tapes).

Lectures were given in both formal (class) and informal (on-site) settings, with the first two weeks of the program located at Bradley University and emphasizing the urban environment. The final two weeks focused on the rural/forest environment in the Sun Foundation and Marshall County Conservation Areas.

Approximately thirty participants were selected each year from the sixteen country area surrounding and including Peoria, Illinois. They had from 2-25 years of teaching experience. All had to agree to serve on a precollege/college committee to focus on science education in Illinois, and to provide a systematic presentation of the information gathered to their local school or school district. University staff assisted participants from previous years in developing these presentations. Evaluation of the projects consisted of:

1) An assessment instrument to ascertain how well the project met the objectives on behalf of both participants and staff.

2) A follow-up questionnaire sent during May (9 months after the project) to both the participants and their principals to explore (a) the type of in-service training or materials the teacher presented to his/her faculty; (b) any noted effect on the faculty/students as a result of this in-service training or materials; (c) the need for science education in-service offered by the Bradley University staff to the given elementary schools; and (d) the difference in teaching science the project made (techniques, contents, etc.)

Results of these are available through the Project Director.

| | | |
|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $22,763 | $23,063 |
| Discipline: | Interdisciplinary | Interdisciplinary |

## An Interdisciplinary Approach to Up-Grade Elementary School Teachers' Content Background in Science

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Illinois State University sponsored a summer and academic year institute in science education for teachers of grades four through eight during the 1980-81 school year. Fifty elementary and junior high school teachers from the Central Illinois area participated in this project. The teacher participants studied selected topics in physics, biology and geology which were designed to up date and upgrade their content background in these scientific disciplines.

The project consisted of two phases--a summer institute and an academic year follow-up workshop. The intensive four-week summer institute was conducted from June 16 through July 11, 1980, on the campus of Illinois State University from 8:30 a.m. until 4:30 p.m. daily. The latest equipment, technology, methodology and information from each of the science disciplines were explored in-depth by the teacher participants. Instruction was provided by scientists from the departments of physics, biology, geology, and curriculum and instruction.

These same scientists-instructors provided mini-courses in energy, physics, chemistry, geology, biology, and botany for the 50 teacher participants on the campus during the 1980-81 school year. These once a month Saturday meetings during the 1980-81 school year proved to be extremely valuable follow-up sessions. The interaction among teacher participants centered on implementation strategies of scientific ideas with children in their classrooms. These interactions proved to be very reinforcing and constructive as the scientific content presented in the college classroom was translated into viable units and activities for boys and girls in elementary and junior high schools.

Participants were queried upon conclusion of the project regarding the extent to which the objectives of the project had been achieved. Their response was as follows:

- the project had successfully upgraded their science content backgrounds;
- it had increased their confidence in teaching science;
- they were able to implement specific scientific ideas in their classrooms;
- the workshop had provided them a variety of up-to-date, hands-on laboratory experiences to present to their intermediate and junior high school students;
- as a result of the workshop, they established closer ties with University scientists who could be called upon to serve as resource consultants in the classroom.

Fundirg Year: 1980
Grant Amount: $33,338
Discipline: Interdisciplinary

Environmental Education Workshop for

Macon County, Illinois Elementary Grade Teachers

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Illinois law requires that conservation education be taught in all public schools (K-12). Macon County, Illinois, is unique in having a well-developed Center for Environmental Discovery available; however, the potential use of the Center has been severely limited in the past by the lack of content knowledge and skills among elementary school teachers using the facility. The purpose of the Millikin project was to address this need.

The specific objectives of the project were:

1. To improve content knowledge of participants in principles of Botany, Zoology, and Environmental Science.

2. To improve content knowledge of participants in the application of general principles of Zoology, Botany, and Environmental Science to the local environment.

3. To improve knowledge and skills of field work necessary to allow participants to adequately utilize neighborhood, community, and regional environmental facilities for elementary school students.

4. To improve content knowledge of participants in the history and characteristics of the local environment.

5. To improve the ability of participants to utilize the Rock Springs Center for Environmental Discovery in providing experiences for students in compliance with Illinois State Board of Education guidelines.

6. To improve working relationships between teachers in Macon County, Illinois, naturalists at the Rock Springs Center for Environmental Discovery, and Scientists at Millikin University.

The workshop was conducted from June 16-27, 1980 on the campus of Millikin University and at the Rock Springs Center for Environmental Discovery, both of which are located in Decatur, Illinois. The general project plan provided instruction in principles of Zoology and Botany during the early parts of each day of the workshop, with field work at the Center for Environmental Discovery during the late morning and afternoon hours. The Zoology segments progressed from study of the characteristics of the major groups of living animals to factors affecting location and functioning of communities of animals. The Botany segment progressed from basic structure and physiology of plants to factors affecting plant growth and distribution.

Using a theme of energy flow, and building on the principles and details being discussed in the Zoology and Botany segments, the field work portion of the workshop began by providing instruction on, and observation of, the Macon County Environment, including its archeological history. Field trips to selected sites displaying community efforts to maintain the environment, including land fills, sewage treatment plants, and a nuclear power plant followed the initial instruction at the Center. During the second week of the workshop, field activity centered around methods of using the Center, as well as areas near the participants' schools, including developing nature trails, using established curricula and materials, and planning pre- and post-field work science activities. A final feature included instruction and discussion of multi-disciplinary aspects which can be developed through use of field studies.

Teachers using the Center in the past have cited their lack of concrete information about the Macon County environment, and about principles of science which can form a basis for the development of teaching units as reasons for their hesitancy to use the Center more often; therefore, the project was designed to take participants from basic knowledge of the structure and function of plants and animals, and an understanding of the history and characteristics of the Rock Springs Center for Environmental Discovery, to an examination of the specifics of the environment, and techniques for helping students study the environment. Study of the history and characteristics of the Center is, in essence, the history and characteristics of the Macon County environment.

Funding Year: 1980
Grant Amount: $21,366
Disciplines: Botany, Zoology, Archeology

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## Mathematics Project for Teachers of Grades 1-4

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The broad objectives of this project are to increase the participants' mathematical backgrounds, provide them an opportunity to use physical models to learn and teach mathematical concepts, and to write teaching-learning units related to topics taught in the project. The course topics include whole numbers, algorithms for the whole number operations, fractional numbers, plane geometry, and measurement.

Thirty-four teachers are involved in the project. Sixty-two percent of the participants have five or fewer semester hours of college credit in mathematics and have not completed a college mathematics course for credit since 1970.

Classes were held from June 22-July 17, 1981. Following the formal class sessions, all participants completed at least two teaching-learning units, evaluated by the project instructor. The writing of these units provided the participants an opportunity to review the mathematical concepts developed during the class meetings and to write the concepts into appropriate language for the children in their classrooms.

After the participants have had the opportunity to teach their units during the 1981-82 school year, they will share their successes and failures with the project director in the follow-up visits which are an important part of the project. The project instructor's visit to the participants' school gives the instructor the opportunity to assist the participants in the writing of additional units, to advise them in the purchase of or making of manipulative devices, and to make suggestions about means of implementing teaching methods exemplified in the project in their individual teaching situations. Also, the school visitations provide the project instructor an opportunity to discuss the project with the school building principal and to discuss, in an informal way, the teaching of mathematics with other teachers in the building.

The participants will complete a written evaluation of the total project in May 1982.

Funding Year: 1981
Grant Amount: $10,702
Discipline: Mathematics

# Improving the Science Background of Elementary School Teachers in Schaumburg, Illinois

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The objective of this project was to launch a 3-5 year program to improve the science background and science teaching of the 632 K-6 teachers in Schaumburg, Illinois. During the funding year (1981-82) a cadre of 50 teachers received in-depth training in science and use of science teaching resources. These teachers will work with Northern Illinois University (NIU) scientists/science educators to improve other teachers' backgrounds.

Specific objectives are to improve teachers':

1. knowledge of (a) fundamental concepts and recent advances in biological, earth, and physical science, and (b) the science content of the local curriculum.

2. Awareness of appropriate instructional strategies for teaching science concepts, and use of instructional resources.

3. ability to use district resources and identify and use resources of the regional university to facilitate their own and student learning.

Related objectives are:

1. to help university scientists become aware of knowledge needs of elementary school teachers and develop innovative science courses, seminars, etc., to meet these needs.

2. to initiate a long-range teacher/scientist planned continuing education program so teachers and scientists can carry out formal and informal experiences to develop knowledge and awareness of instructional strategies.

3. to encourage women teachers to serve as role models, developing non-stereotyped attitudes toward science and promoting more science-related career choices among their female students.

4. to develop an inquiry knowledge-based science curriculum that will create an early interest in science and sustain and promote enthusiasm for science during the adolescent years.

5. to stem the tide of the anti-science movement in elementary schools.

The principal participants were primary level and one intermediate level teacher from each of the district's 25 elementary schools. All remaining teachers (582) in the district will be secondary participants during the project year and years following. The primary participants selected were teachers who have demonstrated a positive attitude toward science and science teaching, a willingness to learn more about science and science teaching, an ability to teach effectively, and the willingness and capacity to assume leadership roles. They are people who can derive personal benefit from the program and who can function as teacher educators.

Training for the cadre teachers (content knowledge, instructional strategies, use of resources, and techniques for helping other teachers) took place in a two-week late summer session (8:30-3:30 Monday through Friday), followed by an academic year program of one evening and one Saturday morning session per month.

Most of the sessions were held in District 54 facilities, an approach chosen to demonstrate to teachers that the content they need can be taught/learned in their own environments. It also brought the scientists involved into contact with school facilities and resources, making them more aware of teacher's needs for equipment and materials and facility limitation. This approach also encouraged an informal atmosphere and laid the base for cooperative relationships.

During the first year, teachers, district personnel, and NIU scientists developed a three-five year continuing education plan. Activities will include self-study, seminars, special courses, etc. The plan will provide in-service education in the district and develop new modes for university scientists to respond to school science needs.

Acquisition of science knowledge by the 50 teacher cadre was measured periodically with self reports, observations, and special examinations, with the results checked against needs assessments so that weak areas would be addressed in follow-up program sessions. Throughout the year classroom visitations assessed instructional improvement. Teachers and administrators were surveyed regarding teachers' added science background, ability to use knowledge, and increased emphasis on science teaching. Long range evaluation, conducted according to the 3-5 year continuing education plan, will include classroom visitations and interviews and surveys of teachers, administrators, and supervisors. Student surveys and interviews, interest scales, and district achievement scores will assist in determining the total impact. All evaluation will be keyed to project objectives.

Funding Year: 1981
Grant Amount: $36,424
Discipline: Interdisciplinary

## Mini-Courses in Astronomy and Physical Science for Elementary School Teachers

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Two independent two-week summer mini-courses, one focusing on astronomy and the other on physical science, were designed for elementary school teachers. Each course accommodated twenty-four participants; a total of forty-three regional elementary teachers of grades three through six attended the two mini-courses.

The program endeavored to stimulate the teachers' interests in astronomy and physical science and provided them with a broader understanding of specific scientific subject matter together with some simple equipment for demonstrating the concepts learned. Each session used lecture, multimedia presentation and a hands-on, make-it-take-it approach in the laboratory-activitity period. Participating teachers first reviewed the basic physical principles involved and then constructed and performed experiments or demonstrations that showed these principles in action in a form immediately applicable to their own classrooms. Learning experiences for participants were thus of a kind that can realistically be extended and applied by the participants on returning to their respective schools.

A continuing relationship was maintained between the University and the teachers through three group meetings for each workshop during the academic year. These meetings provided additional help as needed for general implementation of techniques learned during the mini-courses.

Review of the evaluations seems to indicate that the goals of this project were accomplished. Contacts with the participants during the academic year showed that they had incorporated many activities from this project into their own science curriculum. Many participants brought their classes to Ball State for science and/or planetarium demonstrations during the school year.

Funding Year: 1980
Grant Amount: $20,715
Disciplines: Physical Sciences, Astronomy

## A Seminar in the Use of a Microcomputer as a Teaching Tool for Elementary/Middle School Teachers

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Two independent, one-week seminars were designed for elementary and middle school teachers. The goal of the proposed project was to train teachers to use microcomputers in their classrooms as teaching tools to present concepts to the whole class. They were not trained to be computer scientists. The participants are now able to adapt commercial and staff developed software to their curricular needs. The microcomputer can be used in entire class instruction, small group instruction, or for individualization. The Department's Network of twelve Radio Shack Model I, Level II microcomputers allowed one computer for each two participants. Thus, instruction during the seminar was done with microcomputers as it would be in the classroom.

Each seminar accommodated twenty-four participants; all forty-eight teachers completed the project. Since teachers were not trained in detail in a computer language but just how to use the microcomputer, the one-week format was agreed upon by the staff in consultation with a group of area teachers.

The program endeavored to stimulate teachers' interest in microcomputers and provided them with a broader understanding of microcomputers and their applications in today's schools. Each session used lecture, multimedia presentations and hands-on laboratory experience. The multimedia and computer activities enhanced the lecture materials. This format allowed the participants to experience first-hand what they had learned in lecture and reviewed in the multimedia presentations.

A continuing relationship was maintained betwen the University and the teachers through two group meetings for each seminar during the academic year. These meetings provided additional help as needed for implementation of techniques learned during the seminar and review of new software.

Review of the project evaluations seems to indicate that the goal of this project was accomplished. Contacts with the participants during the academic year show that they have incorporated the strategies taught in the seminar in their classrooms. Some participants are bringing their classes to Ball State to use the Department of Physics and Astronomy's network of TRS-80 mnicrocomputers.

Funding Year: 1981
Grant Amount: $12,964*
Discipline: Computer Science

* Funded jointly by the National Science Foundation and the Department of Education.

## Key Teachers in Economics

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In the 1979-80 academic year, twenty teachers from the greater Indianapolis area participated in the "Key Teachers in Elementary Economic Education" project offered by the Indiana University-Purdue University at Indianapolis (IUPI) Center for Economic Education, funded by the National Science Foundation (NSF). Participating teachers attended an eight-day Summer Workshop on Economics, a three-day summer porgram on economic education materials at the K-6 level, and monthly meetings throughout the academic year. The monthly meetings served as an intensive follow-up program, and supported the participants' efforts to expand and evaluate economic education programs in their different schools. Participants used standardized economics tests to pre- and post-test: (1) students in their own classes, (2) students in the classes of at least one teacher from their school who agreed to serve as a "cooperating" teacher and work with the participant to develop new economics programs, and (3) students in at least one control class from each of the participants' schools. The results were very encouraging: students in the control classes improved their scores (on average) by 20.1%, students in the "cooperating" teachers' classes improved their scores by 39.5%, and students in the participants' classes improved their scores by 89.7%. These results are especially important since they cover such a large number of classes and students, and cover the entire range of primary and intermediate grades.

The current project expands the 1979-80 program to an additional 24 teachers from 24 of the more than 200 elementary and middle schools in the greater Indianapolis area. Such a selection process provides the broadest possible impact. Some past participants have been used as speakers and resource personnel, particularly in the early segments of this project.

Based on experience in the 1979-80 program, all participants are experienced teachers in grades K-8, for several reasons: (1) Most Indianapolis teachers in these grade levels have had no formal training in economics--they start the project on very even terms in this respect. (2) At these grade levels, the economics concepts which can appropriately be covered in the different classes are, for the most part, identical, though depth of coverage naturally varies. This is consistent with major curriculum work in economics, such as the Joint Council on Economic Education's Master Curriculum Guide. (3) Though teaching strategies do vary widely across these grades, one of the strongest aspects of the 1979-80 project involved primary teachers "stealing" activities from the intermediate teachers for their advanced students, and intermediate teachers using primary teachers' activities for their slower students. (4) The 1979-80 project showed that the major sets of economic education materials available to teachers in these grade levels are often transferable across grade levels, at least when used by a teacher with some economics training. (5) Within this range of grade levels, the

participants develop a feeling that teachers at each grade level contribute something to the overall process of economics education, as teachers in the higher grades build upon the general foundation provided by those in the lower grades. This is an essential component in having the participants accept a role as a "key teacher" in this field for their entire school, and not just for two or three grades.

Formal evaluation of the "Key Teachers in Economic Education" project will await completion of the project in the spring of 1982. Pre-test results will be compared with post-test results for participating teachers, cooperating teachers, and the control classes that are not exposed to the new economics programs. Subjective reactions, however, in the form of participants' comments, have been quite favorable. A typical response has been that the monthly meetings have been very important for reinforcement, particularly when one teacher is expected to serve as a catalyst for change throughout an entire school. Current participants have already begun to request and receive "mini-grants" for in-service programs for other teachers in their schools. The results of the 1979-80 project indicate that project participants can be invaluable for teacher education in economics education. In fact, the economics units developed by the 1979-80 participants were quite successful in the statewide Olin-Davis competition in economic education. With key teachers from the previous group providing guidance, the current participants should do at least as well in the state awards competition.

In summary, the "Key Teachers in Economic Education" project is successfully training selected teachers to increase the economic awareness and interest of teachers throughout the greater Indianapolis area. Teachers who are new users of our economic education materials have cited favorable comments by colleagues who have participated in one of the "Key Teachers" projects. In fact, one participant claimed that the only problem with the project has been the difficulty in getting control teachers--because nobody wants to be excluded from using the new materials.

Funding Year: 1981
Grant Amount: $20,479*
Discipline: Economics

*Funded jointly by the National Science Foundation and the Department of Education.

## Science and Mathematics Project

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Elementary and middle school teachers and administrators of our service region (North Central Indiana) have directly expressed a need for more information on the concepts, principles, pedagogical techniques and problem solving skills which underpin their classroom materials in science, mathematics and measurement. The objective of the Science and Mathematics Project at the North Central Campus is to provide a program which meets those needs.

The project was devised with the assistance of a local group of teachers and principals. This group spoke to other teachers and administrators, devised a survey, and, based on the results of that survey, recommended the major features of the project.

The project provided 40 local teachers, grades K-7, with a four week summer workshop. Sessions ran from 9-3:30, Monday through Friday, from June 22-July 17, 1981. The focus was on problem solving skills and on those scientific and mathematical concepts, principles, and teaching strategies which are common to many area curricula and which are adaptable to most curricula. The course also focused on increasing the participants' awareness of curricular resources.

Many of our areas' schools use a hands-on, laboratory or inquiry-discovery approach to learning in their math or science programs. Consequently, we used these methods in our work with the teachers in order to enhance and reinforce their skills with these techniques in their teaching.

The instructional strategy in the program was to use elementary classroom materials to provide a framework and motivation for the investigation and discussion of scientific and mathematical concepts and principles. The project curriculum includes E.S.S. science and math units, the metric system, math lab materials and Madison Project guided-discovery lessons.

Evaluation of the project has been of two types: formative and summative. The formative evaluation was obtained through subjective observations by project staff, solicited comments of participants, and simple one-page biweekly questionnaires. This feedback was used to make immediate improvements in activities and methods during the course.

The summative evaluation was obtained through 3 questionnaires. One was administered to the participants during the last day of the summer workshop. The others were sent to participants and to their principals in January, 1982. These were used to determine 1) the actual use of the project's methods and materials which are transportable to the participants' classes, 2) whether participants have conducted any building-level inservice sessions on project methods and materials, and 3) how the Purdue staff might be of assistance to the participants, their students and their peers.

Funding Year: 1981
Grant Amount: $30,613
Disciplines: Mathematics, Physics, Physical Sciences, Biology

## The Web of Life: Michiana Ecosystems as Natural Laboratories

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A course in ecology and environmental science for teachers of early adolescent students, mainly those teaching in grades 4-6, is being offered by the Department of Biology during the academic year 1981-82. Sessions are held on Saturday mornings on a semimonthly basis. Twenty-four teachers are participating, drawn from North Central and Southwestern portions of Indiana and Michigan.

A major objective of the project is to improve the participating teachers' understanding of scientific concepts and methods. The focus on ecology and environmental science not only allows us to discuss such contemporary issues as air and water pollution, but permits us to teach basic scientific concepts as well.

In addition to training teachers in basic subject matter, an objective is to increase their awareness of their central role in inspiring students to take science subjects. The subject matter of our course, ecological and environmental science, is a good example of an area where social problems and a scientific field interface.

From our "needs assessment" it was clear that teachers hope to incorporate material from the course into their own curricula. Therefore, another important objective of the "Web of Life" course is to aid teachers in the development of materials that can be used in the classroom in science teaching. The course will not only introduce participants to resource people and materials but will also aid them in transforming information from these resources into materials that can be utilized effectively in the classrooom. In "Web of Life", subject matter falls into discrete segments (for instance, there are lecture-laboratory-field trip sequences on each of a number of different ecosystems) each of which can be tailored into "units" for use in the classrooom. Teachers will be aided individually in developing "units" by professors teaching the course, and there will be an introductory workshop specifically addressed to a consideration of science teaching methods. Rather than purchasing a preprogrammed "package" of lesson plans from some educational or industrial institution, this course encourages teachers to exercise their own critical and imaginative faculties in the creation of their own classroom materials.

A final objective of the program will be to continue contact between participating teachers and our university staff. The focus on the ecology of Michiana will enable teachers to identify the university faculty member who is most knowledgeable about a specific ecosystem in the region and who can act as a resource person/consultant about that ecosystem on an ongoing basis.

Funding Year: 1981
Grant Amount: $28,379*
Discipline: Biology

* Funded jointly by the National Science Foundation and the Department of Education.

# Short Courses on Selected Topics of Mathematics and Science

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The University of Northern Iowa's Science Education Coordinating Committee developed this project as a result of a survey involving school systems in the vicinity of Cedar Falls, Iowa. Teachers from these systems enthusiastically supported the concept of a project offering a wide variety of short courses (of one semester hour in length). Their course preference reflected: current environmental concerns; interest in new developments in science and mathematics; and interest in basic and introductory subjects they may be required to teach for which they have little or no preparation.

The short course format has several strengths:

1. It makes possible meaningful inservice education on a wide variety of topics without obligating either the inservice teacher or university faculty for a full semester or year of extension work.

2. It exposes area teachers to a larger number of university scientists than a traditional approach might.

3. It exposes a larger number of university scientists to the needs and problems of elementary and secondary teachers.

4. It permits time for rearrangment, if necessary, to include the possibility for offering popular modules a second time in place of modules with projected low enrollments.

5. It meets the needs of area elementary and secondary teachers.

6. The elementary courses are related to the teaching responsibilities of the elementary school teacher.

7. The secondary courses are related to the teaching responsibilities of secondary teachers.

During the 1981-1982 academic year, 18 courses covering a variety of basic science and math topics were offered on campus to approximately sixty area teachers. The fall and spring semesters each were divided into three time periods, providing six time slots for course offerings. Three course were taught each time period with an average of twenty participants enrolled in each course. Each module met five times for a total of sixteen hours of instruction.

The courses offered (with teaching levels in parentheses), are:

Microscopes in the Elementary School (2-6)
Electricity for Elementary Teachers (K-6)
Science and Society (7-12)
Weather (K-6)
Rocks and Minerals (K-6)
Iowa Insects (K-6)
Astronomy Update (7-12)
Naked Eye Astronomy (K-6)
Alternate Energy Sources (7-12)
Lasers and Holography (7-12)
Metric Activities (K-6)
Environmental Chemistry (7-12)
Iowa Plants and Flowers (7-12)
Chemistry for Elementary Teachers (K-6)
Energy Activities for Elementary Teachers (K-6)
Micro-Computers in the Middle School (5-8)
Hand Held Calculator Activities (4-8)
Math Activities in the Elementary School (1-5)

The courses which span the K-6 levels do so because almost all elementary schools in the region still have a traditional K-6 arrangement. Also, experience has shown that K-6 teachers all look for the same type of basic subject matter background, as well as teaching strategies. This type of grouping also allows for efficient use of funds, with teachers from any level in the same elementary school being able to travel together to the workshops. In the past, teams of teachers have helped to put together science curriculum materials for their schools because of their similar backgrounds in this type of workshop, even though their teaching levels were not the same.

The instructors taught their modules through a variety of formats: lectures, demonstrations, laboratory experiments, field trips, and student projects were asked to determine how well the program met their needs and what changes in format, if any, should be made. As part of the evaluation program, participants were also be asked to specify how they think area teachers and their students can best utilize the skills, talents, and resources of UNI scientists.

Faculty follow-up visits to classrooms helped to determine the impact of the project on teachers and students in eastern Iowa schools.

Funding Year: 1981
Grant Amount: $40,594
Discipline: Interdisciplinary

## Environmental Science for Elementary School Teachers K-6

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The Emporia State University Division of Biological Sciences with the cooperation of the Department of Earth Science offered an academic year Environmental Science program for 60 elementary teachers (K-6). This project was based on the primary assumption that elementary teachers must be knowledgeable in the appropriate environmental science-subject matter, be aware of various acceptable instructional approaches, and use appropriate materials in environmental science in order to convey environmental science concepts to their students. In accordance with that assumption the project was designed to provide the 60 in-service elementary teachers an opportunity to gain an understanding of the philosophy and rationale supporting an inquiry approach to teaching and to gain appropriate and adequate subject matter in environmental science. Additional objectives of the project included opportunities for the participants to design investigative environmental teaching units for their own use and to assist the teachers in the incorporation of knowledge and materials obtained during the project into their own teaching. A three-hour subject-matter course in environmental science was taught one evening a week by five biology professors during the Fall Semester 1980, to two separate classes of 30 participants each. During the Spring Semester, 1981, the participants were grouped by elementary grade level and each group, assisted by the faculty instructors, constructed as many appropriate environmental science teaching units as possible. Curriculum materials on environmental science and other areas of science, previously developed by NSF funding, were utilized during the project as subject matter and resource materials. Some of those programs were OBIS, HAP, BSCS Elementary Science and the Kingsport, Tennessee, Public Schools Energy Activity Packets. A total of more than 80 units were written, about 120 were tested in the classroom, and about 60 units were judged to be acceptable and were put into a bound volume for each participant. Each participant received an additional one hour of Physical Science graduate credit for taking a total of fifteen classroom and field hours of instruction in environmental earth science.

The bound volume of the environmental science teaching units was titled "Activities in Environmental Science for Elementary Schools". It is now being used by more than 200 elementary teachers in Kansas, including the participants of the project. The book is being made available at no cost on a statewide basis with the requirement that at least one teacher from a school district wanting the book must attend a no-cost workshop conducted by the Director of the 1980-81 Pre-College Teacher Development in Science Project. The workshops are being offered at various professional science meetings (Kansas Association of Teachers of Science; Kansas Association of Biology Teachers, etc.) throughout the State during 1982. Information on other environmental science curricula (OBIS; HAP; BSCS Elementary Science; Kingsport, Tennessee, Public Schools Energy Activities; and others) is also being introduced and disseminated during the workshops.

Funding Year: 1980
Grant Amount: $30,991
Disciplines: Biology, Earth Science

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## Elementary Science Teacher Improvement Project

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It was the intent of this project to meet the following objectives:

1. To encourage elementary teachers to retrain and develop content knowledge in the life, physical and earth sciences that is appropriate to the grade in which they teach and to develop process skills related to this content.

2. To develop and strengthen liaisons between teachers and scientists at the local university and local resource centers (museums, zoological gardens, planetarium, etc.) through mutual involvement in the project meetings, through an internship program at the resource centers, and through scheduled follow-up programs.

3. To integrate science subject matter and process skills with appropriate teaching techniques.

4. To develop a more positive attitude toward the teaching of science in the elementary grades.

Specific needs as they related to school programs were identified through a survey of the immediate five county areas (Jefferson, Bullitt, Nelson, Oldham, and Shelby) to ascertain what science textbooks were in use, with the content of these texts checked for topic frequency. The topics appearing most frequently were then classified under major themes, which were discussed with teachers in an attempt to identify those themes that teachers definitely wanted presented in any in-service work. These themes and topics were then submitted to a select group of about thirty teachers for reactions, and, based on their comments, the following topics were addressed in the workshop:

| Life Science | Matter and Energy Interactions | The Earth and the Universe |
|---|---|---|
| Structure and Maintenance of the Organism; | Physical and Chemical Properties of Matter; | The Earth; |
| The Organism and Its Environment; | Physical and Chemical Changes; | The Earth and Its Environment; |
| Continuity and Change | Changes in Matter and Energy | Beyond the Earth |

Content of the workshops fit appropriately into these themes and topics. There was also an attempt by each instructor to identify appropriate leisure time activities and career opportunities during presentation of content.

Academic work was divided into ten-week segments based on the three general topics: Life Science, The Earth and the Universe, and Matter and Energy

Interactions. Each session consisted of a combination of formal classwork and activitiy/laboratory sessions designed especially for elementary teachers. Participants had opportunities to interact with a number of university and community scientists who are engaged in various kinds of work, and learned about local resource centers such as museums, zoo, etc., with corresponding opportunities to meet with science personnel from these resource centers. Participants also met with teacher-leaders from surrounding school districts who served as model teachers while leading the activity sessions. In addition, a limited number of internships at various community resource centers were made available to selected teacher-participants during the summer following their academic year sessions.

Both 1980-81 and 1981-82 projects were held one evening a week from 4:30-7:00 p.m., from September through May. Participants met at either of the University's Belknap or Shelby campuses, depending upon which site was most accessible to their school district. Participants received six hours of graduate credit which could be applied toward the M. Ed. or M.A.T. degrees, if desired.

Funding Year: 1980 1981
Grant Amount: $34,755 $39,879
Discipine: Interdisciplinary

# Physical Sciences for Elementary Science Teachers

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The first objective of the project was to update and to extend the elementary science teachers' basic knowledge of selected concepts of the physical sciences as they relate to the elementary science classroom.

This objective was accomplished by providing a two-semester program which involved 16 three hour sessions per/semester. Fourteen of the sessions each semester had a format composed of a combination of participant demonstration, staff discussion, "hands-on" activities, exchange of ideas, film strip or film, and staff demonstrations. The middle session of each semester was modified to include a one hour written demonstration. The fifteenth session each semester was used as a review and examination session. Each teacher was assigned to a group of three participants, and each group of three participants received a set of five questions covering concepts covered during the semester. Each participant in the group was responsible for a three minute presentation, which illustrated how they could convey one of the five concepts on the list. Each participant in the group presented a different concept. Thirty minutes of time was allowed for the preparation of the presentations.

The second objective of the project was to improve and to extend the classroom competency of the participating teachers by providing them with a variety of approaches to any given topic of the physical sciences. This objective was accomplished by putting the participants in two-person teams and giving each team the materials to do the "handson" activity used in each session. Two teams were combined to form groups of four when the activity could be completed more effectively by a larger group. Each participant did the majority of the physical science "hands-on" activities in the science textbooks used in the Parish; thus each participant did activities at grade levels above and below the grade which they taught. Additional activities were selected from other elementary science curricula and from the experience of the project staff in an attempt to offer options for presenting a particular concept. Film strips and 16mm movies were used to reinforce and to extend concepts presented in the "hands-on" activities.

The third objective of the project was to develop and to maintain lasting two-way communications between the chemistry staff of McNeese State University and the elementary teachers in Calcasieu Parish. The participation of project staff members and participants in "hands-on" experiences and demonstration coupled with the visitation of each participant's classroom once each semester by a project staff member developed this two-way communication between a number of the participants and the project staff. The following are examples of this ongoing relationship:

- The project director still visits the classrooms of a number of the former participants to present a 30 minute chemical magic program or to teach a concept. Several former participants bring groups to the campus to meet with the project director.

- For the past two summers the project director and several former participants have worked with approximately 30 elementary students, grades 2-6, in an eight session, two hours/session, science program, involving "hands-on" activities. The final session each summer has been a Parents' Night, at which time the students have led their parents through some of the "hands-on" activities they have done in the previous seven sessions.

- Three participants were instrumental in involving the project director as a consultant for 10 days to Cameron Parish, as they wrote their minimum standards on science teaching in grades K-10.

One unusual feature which added to the informal networking among the group was their decision that the class break time could be used productively if pairs of participants would provide refreshments for the break. Each pair provided refreshments once each semester, (15 pairs), and in so doing, came to know each other as persons and as professionals more quickly. The project staff spent the time in informed discussion with participants, resulting in a number of close and productive relationships.

Funding Year: 1980
Grant Amount: $8,068
Discipline: Physical Sciences

## Beyond Environmental Awareness

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St. Mary's Dominican College conducted academic year (fall 1980, spring, 1981) interdisciplinary environmental education courses for elementary school teachers in the greater New Orleans area. The objectives of the program were: (1) to increase elementary school teachers' level of knowledge about natural and social systems and the interface between them; (2) to upgrade elementary school teachers' knowledge of the probable causes and consequences as well as methods for solving environmental problems; (3) to introduce elementary school teachers to examples of local ecosystems and environmental problems developing in southern Louisiana; and (4) to increase elementary school teachers' knowledge of, and skill in using, materials and strategies for environmental education.

The courses, which meet on Wednesday from 6:00p.m. to 9:00p.m., were team taught by five Dominican College faculty members (three from the Education Division and two from the Science Division). Generally, the first half of each class was devoted to ecological principles and concepts, and the remainder was devoted to methodology. All faculty attended every class, thereby emphasizing to the participants that the topics were not independant topics but truly integrated ones. In addition, the faculty team met in planning sessions for one and one-half hours each Monday.

As one part of the course requirements, the participants had to develop and teach to their classes an environmental education unit. Follow-up work and classroom visits with them indicated that they did indeed use environmental education materials and methods in their classrooms. Additionally, as part of program evaluation, the participants evaluated each class in terms of content and faculty teaching performance. In this way the project team was continually aware of participants' feelings regarding the course. We found this weekly evaluation very helpful. And it kept us on our toes!

Percentage of Completion

Fall 1980 - 80%
Spring 1981 - 95%

Funding Year: 1980
Grant Amount: $33,366
Discipline: Environmental Education

# Using Cartographic Communication Skills in Elementary School Classrooms

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The project sought to improve science education in elementary schools through a program which trained teachers in the communication processes of cartography (map reading, map making, and interpretation of aerial photos). Twenty teachers from elementary schools in the Baltimore area were selected. The program had three stages: a four-week intensive program of study in the summer of 1981, two progress report meetings of all participants during the academic year and at least one visit by the project director to the classroom of each participant during the academic year.

The program started with an overview of cartography including a discussion of the mission and the techniques of cartography and mental mapping. This was followed by a review of the basics of cartography: latitude and longitude, map distortion and projection, and scale. This was found to be very helpful to the teachers. It also provided a familiar framework within which to begin the intensive work, and to develop rapport among the members of the class and the director.

This introduction was followed by exercises and lectures on the reading and use of topographic maps, aerial photographs and remotely sensed images. From this the program proceeded to an intensive consideration of map layout and design, and techniques of mapping quantitative data: dot maps, isolines, choropleths, graduated circles and bars, cartograms, and a variety of graph and chart techniques. Participants learned how to use the techniques and then constructed maps using each of them. Materials and equipment used in cartographic drafting were demonstrated and then used by participants during this aspect of the program.

The final part of the instruction in cartography involved simple field mapping techniques. Participants were taught to use a directional compass, a simple level, a tape, and pacing to construct maps directly from field experience. This was a very successful exercise. The teachers realized very quickly that they could do activities with their own classes similar to the ones they were doing in the summer program.

The summer session concluded with a discussion of applications of cartographic techniques in the elementary school curriculum, followed by participant presentation of projects they had developed for use in their classrooms in the fall. Participants shared material and ideas with real enthusiasm; it was an excellent conclusion for a highly successful and productive program.

The group meeting in November confirmed the success of the program. Not only had participants introduced new ideas, techniques, and materials into their own classrooms, they had also shared their experience and knowledge with fellow teachers. Thus the program was achieving another of its goals, i.e., to increase the quality of science education through the multiplier effect of training a cadre of intelligent and motivated teachers.

Pretests, administered the first day of the summer program, will be compared with posttests, given at the spring group meeting, as a measure of the program's success in improving the teachers' skills in and knowledge of cartography. The teachers' evaluations, written at the end of the summer session, substantiate the popularity and success of the program with the participants.

Funding Year: 1981
Grant Amount: $16,512*
Discipline: Geography

* Funded jointly by the National Science Foundation and the Department of Education.

# Computer Literacy Workshop for Elementary Teachers

Dr. Richard H. Austing
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This three-week workshop was held at the University of Maryland, July 6-24, 1981. Its purpose was to impart computer literacy knowledge and skills to 30 teachers actively involved in teaching 4th-6th grade students in the District of Columbia and Prince George's County, Maryland. These two districts were targetted as being disadvantaged in the use of computers in their instructional curriculum. The philosophy of this project was that such skills can be used to integrate computer ideas into the existing curriculum without making major changes to it. It was intended that the participants from the workshop would gain enough knowledge and confidence to become computer literacy facilitators in their own systems and will help to train others.

The project involved small group lectures half of each day with half of the participants. At the same time, the other half of the participants worked in the lab, gaining hands-on experience with microcomputers. Workshop topics included programming concepts with the language BASIC, computers in fiction, history of computation, applications of computers, techniques and resources for integrating the material into their curriculum, and the social impact of computers. Much time was spent involving the participants in activities such as developing lesson plans and visual aids, as well as participating in a number of demonstrations and games which they could use in their own teaching environments with 4th-6th grade students.

During the first few days of the workshop, many teachers were very tentative (one was almost hostile) about using microcomputers. Anticipating this, we provided eight microcomputers so that two teachers were assigned to each machine. The result was that teachers helped each other overcome their fears. In this way, also, the teachers gained some experience, without realizing it, in being facilitators for other teachers, one of the goals of the workshop. By the end of the second week, a number of teachers were staying after closing time to get additional programming experience and to try to complete a specific programming application of their own design. Most of the teachers were sorry to see the workshop end and freely expressed their views that it had been one of their most rewarding experiences.

During the first day of the workshop an eight question computer literacy self evaluation was administered to all of the teachers. The same evaluation was then administered at the end of the workshop. Average responses ranged from 1.4 to 2.9 on a scale of 1 to 10 (1 indicating disagreement or no knowledge) in the pre-workshop evaluation and increased to a range of 7.6 to 9.3 on the post-workshop evaluation. This dramatically indicates that the following objectives stated by participants on the first day were met:

1) To improve their level of computer literacy.

2) To master and apply programming techniques for solving elementary level problems using computers.

3) To accumulate a collection of existing computer-related material and resources suitable for use in grades 4-6.

4) To acquire skills and confidence in developing computer-related material for use in curriculum of grades 4-6.

5) To become facilitators in helping other teachers of grades 4-6 to utilize computers in the classroom.

These objectives coincided with our goals for the workshop.

A second means of evaluating the project was a 53 question Literacy and Awareness Assessment published by the Minnesota Educational Computing Consortium (M.E.C.C.) which was administered at the beginning and again at the end of the workshop. The results are also dramatic. Scores increased from a range of 23 to 50 (median of 36.4) on the pre-test to a range of 35 to 53 (median of 45.8) on the post-test.

The immediate goals of the workshop were met, but the evaluation mechanisms did not measure how well the workshop prepared the participants to include computer-oriented material in existing curriculum. To this end, we included in the project an evaluation based on actual visits to each of the participant's schools during the 1981-82 academic year. These on-site visits will determine what the teachers have implemented or are planning to implement in the classroom. In addition, the visits will provide a means of follow-up assistance to those teachers who have a need for it.

Funding Year: 1981
Grant Amount: $27,730
Discipline: Computer Science

# Improving Earth Science, Energy and Environmental Education

# in Grades One Through Four

Dr. Robert Dillman
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The thirty-six elementary school teachers and four principals that attended the intensive one-week summer session followed by eight three-hour inservice evening workshops, and two all-day Saturday sessions were engaged in a number of activities. These activities were designed to: 1) update the background of teachers with respect to new developments in geography, earth science, energy; 2) encourage modern methods of teaching these topics; and 3) acquaint the teachers with community resources. Micro-teaching experiences involving eighty-five elementary school children from the Bridgewater school system were conducted on one Saturday, and an all-day field trip on the other Saturday. Additionally, television taping of teaching and running field trips using community resources were conducted.

"Hands on" activities and new teaching techniques in Earth Science, Geography, Energy and Environmental issues were developed. Community resources was the focus of most of the activities and I feel we succeeded in getting teachers to try and utilize school playgrounds, local stores, and individuals as key community resources for activities in both science and social studies programs. Many of the projects were small, inexpensive, and made from scratch, and were designed to show how local examples are very effective teaching tools.

We succeeded in changing attitudes in a large percentage of the teachers. We were successful in breaking down some of their anxiety over science teaching, were able to get them to feel comfortable using local resources in social studies. Some of the reasons for their unwillingness to teach science or to use field geography in social studies, was their lack of success in teaching either area in their own school system. Additionally, we discovered that a vast majority of the teachers were not well prepared in science or geography, but with some success in trying out activities, their attitudes were radically improved towards building up their knowledge base on their own. This was one of the most gratifying parts of the program - the realization that we were making some progress in changing their anxiety towards teaching science. The use of community resources was also changed dramatically. They were all familiar with going to the food store or to the fire station in their geography lessons, but we were able to get them to use the trip to and from the store as a critical part of their field lesson. The use of skills in map making was confined to the classroom but applied to mapping the types of foods in the store, so that kids were doing rather than just listening to the store manager. This activity was taped by our A.V. Department and was an excellent learning experience for the teachers.

Another success was the TV taping program itself. Teachers felt a little uneasy about being viewed as they taught, but found that they learned a great deal about their own teaching strategies because of it. This was one of the main points mentioned in the evaluations done after the program.

Perhaps the most important element of the program was the initial beginning of a network of committed teachers and administrators who want to work towards better teaching and the sharing of ideas. Of the forty people in the institute, twenty-seven felt they wanted to work beyond this course as a local diffusion agent in their own school system. We hope to meet twice this spring to get the program in motion, and anticipate a growing number of teachers in future years.

We hope to get some college support for the concept and provide adjunct professional ratings to network members. We cannot pay these teachers for their efforts, but we feel any publicity or other types of awards should be extended to these very special people.

As in all programs, some parts were not totally successful. The small number of administrators really bothered us. We tried to get the program to them early, but found varied reasons for not attending. This is one area that we feel could have been improved. Secondly, we also found distribution to teachers was not totally carried out. Over one thousand brochures were sent out during the spring but many teachers never received them because of breakdowns in communication between principals and teachers. This was a real disappointment, although part of this lack of communication was probably due to the onset of proposition 2 1/2.

In summary, I feel the program had an excellent beginning towards improving the backgrounds of teachers, but more significantly in changing attitudes about teaching. Perhaps this last modification was the single most important part of the program if one views success in a long-term perspective.

Funding Year: 1981
Grant Amount: $16,958
Disciplines: Earth Science, Geography

## Global Studies in Elementary Education:

## A Multidisciplinary Approach

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The project, addressed to elementary teachers, was a direct response to the research literature describing the importance of the elementary years in development of a child's national identity and intercultural perspectives - essential factors in worldwide understandings and actions. The project was designed to raise awareness, train techers and identify and compile resources for elementary programs in the greater Boston area. To that end, the project consisted of a two-day conference, a graduate-level course, and compilation of a resource directory of global studies programs and organizations.

The two-day conference attracted 120 participants from school systems in the greater Boston area and surrounding suburbs. The graduate-level course enrolled 23 students, the majority of whom were selected from conference participants. The third component of the project was the compilation of a resource directory which included cultural institutions, special projects, organizations and professionals that focus specifically on global studies for children in grades K-4.

Overall, the conference participants agreed that they had learned basic ways in which global studies could be infused into a K-6 curriculum and that they were introduced to new resource materials and new strategies for teaching global studies. Participants in the graduate-level course generally felt that they were better informed and more familiar with the topic after completing the course. The resource directory is included in the Wheelock College Library's extensive collection of materials on global studies, some of which were purchased with funds through this project.

Funding Year: 1980
Grant Amount: $27,029
Discipline: Social Sciences

Summer Field Workshop in Michigan History,

Geology and Natural History

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A three week summer program for elementary and middle school teachers was offered by the departments of biology, geology and history at Central Michigan University. The accomplished goals included 1) acquainting the teachers with the diversity of fauna and flora in Michigan integrated with its geology and cultural history, 2) providing the teachers with a pool of resources available to them as Michigan teachers, 3) assisting the participants with the development of instructional materials useful in the classroom and 4) creating an atmosphere of continued cooperation between the program participants and faculty.

Coursework included three major field trips to each different geographic sector of Michigan's lower peninsula. The trips involved bus travel between sites, overnight camping and food preparation. Each trip was introduced in the classroom to put it into perspective and to instruct the participants in appropriate instructional materials development. The site visits were interdisciplinary, incorporating historical sites, wildlife areas and areas of significant geological interest. Campfire discussions encouraged the teachers to apply their new knowledge and resources to their own classroom situations. Following each major field trip, one day was spent in evaluation and developing skills in museum techniques related to areas of instructional development.

In addition to aiding the integration of the three disciplines, the campfire sessions and informal field atmosphere fostered a close tie between the elementary and middle school teachers and the program faculty. Fall and spring drive-in seminars were held on special, requested topics which drew the group together during the academic year. The program faculty made many visits to particpant's schools, providing them an additional classroom resource.

Funding Year: 1980
Grant Amount: $29,184
Discipline: Interdisciplinary

## Summer Field Workshop in Michigan History and Geology

Dr. Claudia Douglass
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The departments of biology and geology at Central Michigan University co-sponsored a multidisciplinary, three week, summer program for elementary and middle school teachers. Thirty-two teachers of grades K-9 participated in the 1981 program which was held at the CMU Biological Station on Beaver Island. The participants were divided into three groups according to the grade they taught. Therefore, all instruction was in a small group format appropriate for outdoor education.

The specific goals of the program were to 1) acquire new knowledge and field techniques needed to competently teach Michigan natural history and geology, 2) develop an organized resource file of natural history areas, Michigan vertebrates, national and local endangered species, and classroom animal husbandry, 3) prepare a journal of representative fauna, flora and geology to be supplemented by collections, 4) complete a "Habitat-Pac" reference booklet linking typical habitats with fauna, flora and geology, 5) create several, graphic, hands-on teaching aids, 6) acquire a working knowledge of the facilities available at CMU in the areas of science and instructional materials development, 7) exchange ideas, teaching techniques and resources with fellow teachers from across the state, and 8) become acquainted with CMU faculty who are willing to visit elementary and middle school classrooms.

The program was held at the Biological Station and focused on field experiences. Each group received daily instruction introducing the day's activities, then headed for the field, returning for lunch or in the evening. Evening discussion sessions integrated the activities and allowed for the exchange of ideas. Two major field trips to neighboring uninhabited islands were of considerable educational benefit. The close proximity of the Station to wilderness areas conserved time otherwise spent on buses.

On a rotational basis one group would focus on the geology of the area, another on the fauna of the area and the third on the flora of the area. Sometimes they would return for lunch but they would always gather to exchange new ideas over dinner. In the evening there were frequently fire-side discussions of teaching techniques or problems. Some evenings were spent working on projects. Although participants were free to return to the mainland on the weekends, special field trips were scheduled for those times. Often the participants' families joined them at the Biological Station on Beaver Island where they could camp or stay in the dormatory.

There were many advantages to the on-site instruction and the total availability of the faculty. Several significant projects were completed by each participant. Examples of the teaching aids they made include geological models and mounted rock charts, mounted twig and leaf identification charts, plaster animal sign impression charts and animal activity trays. Each teacher also kept a complete journal of all fauna, flora, fossils and rocks seen on field trips to be used later as a classroom reference.

During the fall semester, the teachers gathered at CMU for a drive-in seminar. They learned latex imbedding techniques and were able to permanently preserve some soft-bodied specimens for classroom use. Also throughout the school year, interested faculty visited the classrooms of the participants as part of the Visiting Scientist Program.

The summer program and its academic year follow-up programs were a success. Everyone agreed that they greatly increased their knowledge and skills. They were enthusiastic about using this information in the classroom in their teaching years head.

Funding Year: 1981
Grant Amount: $39,804*
Discipline: Biology, Geology

*Funded jointly by the National Science Foundation and the Department of Education.

## Project for Elementary School Teachers in Multi-Disciplinary Science

Dr. P. Daniel Trochet
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This project was funded in both FY 80 and FY 81; and supported the training of teachers (40 in the first year and 80 in the second) of grades K-6, from south-eastern Michigan. The objectives were as follows:

1) To improve the teachers' subject mater competence in the areas of biology, chemistry, earth science, and physics and astronomy.

2) To improve the teachers' instructional effectiveness in science.

3) To promote more positive teacher attitudes toward science and the teaching of science.

4) To develop close and lasting relationships between the teachers and science educators from the host institutions.

The summer phase of both projects involved an intensive weekend of science activities at the University-owned Kresge Environmental Education Center near Lapeer, Michigan in late August. During the academic year phase in 1980-81, twenty-four weekly class sessions were held at two centers located approximately 30 miles from the main campus. These classes started in early September, 1980, and ended in early April, 1981. Twenty participants from within a reasonable commuting distance were assigned to each center and attended classes at that center throughout the academic year. Staff members from four subject matter areas (biology, chemistry, earth science, and physics and astronomy) conducted six consecutive class sessions each at each center during the academic year. Staff members rotated to a new center after completing six sessions. Discovery, inquiry and process skills were emphasized through hands-on activities using simple and inexpensive materials and equipment.

The format for the academic year portion of the project was changed in 1981-82. Due to the difficulties in transporting laboratory equipment from the University to the centers, and other logistical and scheduling problems, it was determined that it would be preferable to bring the participants to the University campus for all the academic year classes. This proved to be a highly satisfactory arrangement for all, since most of the participants could easily get to the campus and liked the university atmosphere, while the instructors found it much preferable to use the university laboratories for their teaching. Being at the university also fostered the development of ties between the teachers and the science educators at Eastern Michigan. The content of the coursework was similar to that in the 1980-81 institute; only the format had changed.

In order to evaluate the effectiveness of the project in terms of the improvement of the subject matter competence of the participants, the project staff members developed a test consisting of equal numbers of items from the content areas of biology, chemistry, earth science, physics, and astronomy. It was administered as a pre-test during the kickoff weekend session at the end of August, and as a post-test after completion of the academic year phase in the spring. Scores in general showed significant gains on the post-test.

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|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $31,417 | $52,588 |
| Disciplines: | Interdisciplinary | Interdisciplinary |

## Physical and Earth Science Concepts for Elementary School Teachers

Professor Michael L. Agin
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This project provided 22 elementary school teachers the opportunity to strengthen their academic preparation in the physical and earth sciences. Participants met one evening (three hours per evening) a week for 28 weeks during the 1980-1981 school year to study selected physical and earth science concepts through classroom and laboratory activities.

The topics included the goals and nature of science education, measurement, air and weather, matter and energy, the earth and its surface, and the earth in space. The sessions included lecture-demonstration sessions, laboratory activities, curriculum planning in small groups, and building simple apparatuses for teaching physical and earth science concepts. A field trip to the Seaman Mineral Museum at Michigan Technological University was also a part of the program.

The director of the project made two visits to the participants' schools in order to help the teachers implement the materials and curricula they developed, evaluate their progress with these materials, and to engage other teachers and administrators of these schools in discussions about the project, its goals, and science education in general.

An evaluation of the program was conducted at the last of the 28 sessions, and revealed significant participant satisfaction with the workshop staff, laboratory activities, and attainment of project objectives. It was recommended, however, that future projects be scaled down, focusing on fewer concepts in a 14-week time span, rather than the broad 28-week series as was presented.

Funding Year: 1980
Grant Amount: $21,933
Disciplines: Physical Sciences, Earth Science

## A Leadership Program in Mathematics

## for Detroit Teachers Grades K-4

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The Leadership Program in Mathematics was proposed because there was a critical need to improve the teaching and learning of mathematics in Detroit elementary schools.

The general goals of the program were:

1) Identify teams of educators (teachers and administrators) who have an interest in and commitment to mathematics education leadership;

2) Increase the mathematics and mathematics education backgrounds of participants;

3) Prepare participants to work together as staff development teams;

4) Foster a continuing relationship between the University and the Detroit public schools.

Fifty-two teachers, from the more than four hundred who applied, were selected to participate in the program. The teachers participated as members of "leadership teams" representing fifteen Detroit elementary schools.

The teachers enrolled in a total of five classes, two each during the Fall 1981 and Winter 1982 semesters, and a five-day intensive leadership development workshop in June 1982. Each teacher received 13 semester hours of graduate credit for successful completion of all aspects of the program. The fall and winter classes were designed to increase their knowledge of mathematics, and methods and materials for teaching it. The June five-day workshop dealt with leadership expectations, styles and skills and with the development of an action plan for improving mathematics teaching and learning at the participants' schools. Each leadership team was required to design an inservice module to be implemented during the 1982-83 school year.

Deferred credit was given for the leadership workshop until leadership teams carried out their action plans proposed in June. A summary report that included the plan, inservice module, and results of the inservice was the requirement for processing grades and credit for the June 1982 leadership workshop.

Funding Year: FY 1981
Grant Amount: $42,076
Discipline: Mathematics

## Improving the Effectiveness of Micro-Computers in the Teaching of Science and Mathematics in the Elementary Schools

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This project sought to provide a model for improving the effectiveness of microcomputers as instructional tools in the science and mathematics programs of the elementary schools in the 21 school districts that comprise Michigan's Macomb Intermediate School District. The participants were six computer instruction specialists selected from six school districts, each of whom worked with a group of six fourth, fifth or sixth grade teachers from their home school districts. The institute consisted of (1) a two-day intensive computer assisted instruction leadership program to prepare the six computer instruction specialists for their leadership roles in working with the participants in the institute and the academic year support services, and (2) an institute during the fall of 1981 for the six teams of teachers from the six school districts that have microcomputers in their elementary schools.

The institute had three focuses:

1) strengthening the science and mathematics subject matter skills of all the participants

2) assisting the participants in developing computer programs that can be used as an integral part of the science and mathematics programs of each school district

3) providing the computer instruction specialists leadership techniques and experience in working with the classroom teachers in the development of CAI programs.

During the academic year the teams of participants from each school district field tested the materials they had developed in the institute. The computer instruction specialists served as coordinators and support agents for these field tests. A concluding session was held in May to present the model developed in the institute to representatives of all twenty-one school districts that make up the Macomb Intermediate School District. The model was well received by the representatives who attended this dissemination meeting. They stated that the strengths of the model are:

1) It does not require a high level of computer programming skills on the part of the teacher, and

2) The team of a teacher and a programming expert has resulted in the creation of interesting, exciting, well designed and educationally sound computer programs for students.

Funding Year: 1981
Grant Amount: $30,797
Discipline: Computer Science, Interdisciplinary

## Mathematical Problem Solving for Teachers of Grades 3-4

Dr. Ruth Ann Meyer
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This project's aim was to help 60 teachers of grades 3 and 4 in Southwest Michigan become better teachers of mathematical problem solving. The participants were given the opportunity to solve nonroutine and application-type problems. Explicit attention was given to problem solving strategies such as drawing diagrams, constructing tables, finding related problems, and recognizing patterns. The role of calculators in mathematical problem solving was also evaluated. Since the art of questioning is important to that of teaching successful problem solving, participants were given many opportunities to practice this art. Nine sessions were devoted to these instructional activities.

During three all-day sessions in November 1981, participants constructed problem decks to supplement their mathematics programs. Efforts were expended in examining problem solving resource materials to identify interesting and challenging problems which are free of sexual, racial and socioeconomic biases. Participants also developed instructional units to accompany the problem decks.

It has been our experience that elementary teachers, though motivated to try some new ideas learned during inservice courses, frequently do not integrate these ideas properly into their individual programs. In order to have an influence on the elementary classroom an inservice program should therefore attend to this integration. A primary objective of this project was to develop instructional units designed to incorporate a problem solving strand into the mathematics program. It was found that the most efficient way to provide for the implementation of these materials was through sequencing the activities in a manner which was almost independent of the mathematics text. The effectiveness of this format for implementation will be evaluated during the follow-up sessions in February and May of 1982.

The participant evaluations of the project revealed a high level of satisfaction in meeting the objectives set out in the abstract.

Funding Year: 1981
Grant Amount: $29,592
Discipline: Mathematics

Science and Mathematics Inservice Program

for Elementary Teachers

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This inservice institute for Northern Minnesota elementary school teachers of science and mathematics is a direct result of a comprehensive statewide needs assessment of Minnesota elementary teachers and a telephone survey of principals in Northern Minnesota. The greatest need expressed by the respondents in these surveys was for workshops addressing methods and techniques of teaching elementary science and mathematics. The second greatest need was the acquisition of in-depth subject matter knowledge in newly developing areas.

Based on these teacher responses, Bemidji State University developed an institute with the goal of improving elementary science and mathematics instruction in area schools by:

- Providing participants an opportunity to learn subject matter.
- Proving consultant visitations to develop closer ties between the university and area schools by making the university aware of local problems as well as lending expertise to local schools.
- Applying educational theory and strategies to concepts in science and mathematics.

The institute was set up with the participants attending two classes each in the fall and spring semesters, one evening a week from 6-9 p.m. There were two mathematics classes (one on probability and statistics, and one computer programming, terminal usage, and microprocessors), and a course each in geology and astronomy. Based on the fall quarter materials, and after consulting with course instructors, each participant introduced during the winter quarter a unit or project to his or her own class. During the winter quarter the university instructors conducted on-site visits to the participants to provide consultant services and to evaluate the progress of their units or projects.

Both the participants and project staff felt that the major objectives of the institute were achieved with marked success. New subject matter was presented to the participants at a level and rate that was challenging but not innundating. The popularity of the program is noted by the fact that even though sixty-five participants were accepted for the fifty positions in the institute, the number had grown to seventy-seven by the end of the year.

The consultation visits during the winter quarter were also highly successful. They encompassed a variety of experiences and helped develop new understandings and new relationships between the university staff and local elementary schools. One of the highlights of the program was the four-day science and math education field trip to the Lawrence Hall of Sciences at the University of California at

Berkeley and NASA Ames Research Center in Mountain View, California. By special arrangement with the Air Force, the teachers travelled via cargo plane from Bemidji to the Moffett Field Naval Air Base near San Francisco. At the Ames Research Center they toured facilities and heard a lecture by one of the top researchers in the Voyager I space flight. One day of the trip was termed an "earthquake day", which included a visit to the San Andreas fault complemented by a simulation, at San Francisco State University, of the famous 1906 earthquake. A visit to the San Francisco Exploratorium and various other tours and lectures completed the trip agenda.

Funding Year: 1980
Grant Amount: $32,817
Disciplines: Geology, Astronomy, Mathematics, Computer Sciences

# Improvement of Mathematical Competence in Teachers in Northeastern Minnesota and Northwestern Wisconsin

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Two grants for the improvement of mathematical competencies of elementary school teachers were awarded to the University of Minnesota. The 1980 grant focused on the early primary level; the 1981 project worked with teachers in grades 4-6.

Each project consisted of three components - (1) a 6 credit class that extended over a seven-month period; (2) a visitation program to the schools of the participants to observe classes and to conduct demonstration lessons; and (3) a public relations program with the administrators of the schools in which the participants taught.

In the 1980 project, 48 teachers were involved; they were primarily teachers of kindergarten, or grades one through three. A few Title I, Headstart and special education teachers who work with this age group were selected. Two administrators audited the classes without support.

In this 70+ hour course of instruction, the participants learned about the psychological foundations needed for learning mathematics content. The stage development ideas of Piaget and Cowan and Dienes were considered. The latest neurological research that has importance for mathematics learning was considered.

The participants learned how to develop the different components of number understanding through activities with materials. They learned the teaching of place value ideas, numeration, and comparison relations with emphasis on the origins of equality. The arithmetic operations were worked with in the same way. Materials were also used to develop understanding of the structure of the number system, the major concepts in algebra, and properties of geometric shapes and relations among them. Development of the concept of fraction and operations with fractions using materials was also considered. Problem solving was a major focus throughout the course.

Materials used included beans, cups, ceramic tiles, wooden cubes, UNIFIX cubes, base ten pieces, Pattern Blocks, Geoblocks, Tangrams, geoboards, logic blocks, and non-commercial materials like buttons, bottle caps, etc.

Teachers reacted very favorably to the 1980 course. Most of them have incorporated the ideas they learned into their instruction. They now place greater reliance on their understanding of mathematics, and less on a page-by-page progress through the textbook, as the boss for their instruction. Many use no textbooks at all. They now know better how to get "inside the kids' heads" to find out how they are thinking about mathematics and realize that "right" answers are often obtained for the wrong reasons and wrong answers can be obtained even though good thinking is being done.

Several requests for further information on obtaining materials have come from administrators. Six of the participants are involved in conducting in-service sessions for other teachers in their school systems, so the hoped-for trickle down of training is taking place to some extent. A new interest in improving mathematics instruction is apparent in the schools of these participants and enrollment in related classes in teacher education at UMD has grown.

Directly, this program impacted 48 teachers, about 1500 students and 2 administrators. Indirectly it has probably impacted three times that number in each category.

The 1981 project is training 48 teachers in grades four, five, and six, among whom are a few special education teachers and one administrator who is auditing the coursework without support.

The content of the coursework in the fall of 1981 included the learning characteristics of students in the age group 9-12, and the relationship of these to the mathematics content normally found in the school mathematics program in these grades. The meaning of the arithmetic operations, the teaching of place value ideas, computation in a place value system and the teaching of fractions and operations with fractions were also dealt with in fall, 1981. Participants were given sample lesson plans, worksheet forms and other materials that would supplement the use of materials in developing these topics.

Materials used for each topic included·

Arithmetic operations - wooden cubes, UNIFIX cubes, base ten pieces, ceramic tiles, beans and cups.

Place value - base ten pieces, split boards, worksheets, graph paper.

Fractions - fraction bars, Cuisenaire Rods.

Equality - split boards and base ten pieces.

During the winter quarter, demonstration lessons will be conducted in classrooms of the particpants and meetings held with administrators.

During spring quarter, the mathematics content will include geometry and relations with in geometric shapes, area and volume concept development, relation of place value and fraction ideas to decimal operations, measurement of line segments, areas, volumes, angles, algebra of polynomials as these relate to arithmetic place value ideas, relations and functions and examples such as percent and ratio and proportion. Materials to be used include geoboards, Pattern Blocks, geoblocks, Tangrams, base ten pieces, algebra experience materials, graph paper, Cuisenaire rods, Mira geometry, boxes, cans, calculators and the microcomputer. Continued emphasis will be placed on problem solving and the use of language and symbolic forms in mathematics.

During the fall of 1982 a follow-up of these teachers will be made through classroom observation and school personnel visitation.

| | | |
|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $27,597 | $31,852* |
| Discipline: | Mathematics | |

* Funded jointly by the National Science Foundation and the Department of Education.

## Science Teacher Improvement Project

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The staff of the Science Teacher Improvement Project has maintained their primary purpose to provide content science instruction to elementary teachers from the two support school systems: Hattiesburg and McComb, Mississippi. The project staff proposed three phases to complete the project: developmental, teaching, and evaluation and refinement.

During the summer and fall of 1981, the staff produced materials to teach a course that includes the following science topics: chemical composition and interactions, ecosystems, electricity, and metric measurement. These were the topics identified via the needs assessment from each school system. The materials which were produced contain basic content for each topic and activities which involve the teachers in obtaining and processing data. Suggested instructional techniques for implementing these topics into their classrooms are inherent in the materials as well as exemplified through the instruction by the project staff.

During the developmental phase a brochure describing the project was produced for dissemination to the teachers of each school system. From the applicants, a total of 53 participants (including 5 administrators) were selected from the two school systems.

The teaching phase of the project was initiated during the first part of November. The participants are required to complete a minimum of 45 contact hours to receive 3 hours of university credit. The teaching phase is approximately one-half complete with teachers attending sessions at their respective school systems. Teachers have been requested to teach components of each unit and utilize instructional techniques emphasized during class. Feedback sessions have indicated that approximately 90 percent of the teachers have attempted to incorporate some aspect of the project into their classrooms. The teachers have demonstrated a positive attitude toward the instructional components of the course as well as expressed excitement about their individual teaching efforts with their students.

To assess the effect of the intervention of the inservice model, three instruments were selected for the evaluation of this study: 1) Comprehensive Test of Basic Skills (Science-Level 4), a test comprised of 40 items which will assess the teachers' ability to investigate problems in science; 2) The Bratt Attitude Test (BAT), a Likert-type scale designed to assess teachers' attitudes toward teaching science; and 3) Teaching Style Q-Sort, a twenty-eight statement Q-Sort designed to determine an individual's teaching style. These tests were given to the participants at the beginning of the project and will be subsequently administered when the project is completed. The test battery has been administered to a control group of elementary teachers in a school system near Hattiesburg to obtain data for statistical comparisons.

In addition, the following procedures are being used to collect data for formative evaluation of the teaching materials and instructional program: 1) administration of content tests at the end of each subject unit, 2) administration of a Likert-type rating scale designed to assess the teachers' reaction to the instructional program and the teaching materials, and 3) group feedback sessions allowing participants to express verbally their feelings about the program.

After completing the instructional program and further refining the materials, plans have been made to videotape the teaching of selected lessons from one or two units.

Funding Year: 1981
Grant Amount: $34,463
Disciplines: Biological Science, Physical Science, Chemistry, Metrics

## Involvement in Mathematics of Primary Elementary School Teachers (IMPREST PROJECT)

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The objectives of IMPREST (Summer, 1980 and 1981) were:

1. To improve the lower elementary school teacher's knowledge of the subject matter and methods of mathematics, while being cognizant of the fact that local needs must be taken into consideration.

   The participants received 3 semester hours graduate credit for MAT 508: Mathematical Foundations for In-Service Elementary School Teachers, K-3. The textbooks were five journals, Awareness Geometry, Numeration, Rationale Numbers, Measurement, and Graphs, from the Mathematics Methods Program developed at Indiana University under NSF funding and published by the Addison-Wesley Company. Content was stressed within the framework of a laboratory setting with the participants working in small groups using commercial and/or homemade manipulatives and activities appropriate for each concept.

2. To foster a positive attitude toward mathematics on the part of the primary school teacher.

   The participants were required to read Mind Over Math by Kogelman and Warren. The comments made in their critique of the book reinforced the belief of the staff that a large majority of primary teachers are in awe of and fear mathematics. Patience, encouragement, enthusiasm, willingness, excitement, and sympathy are some of the traits of the instructors of the project. There was a change in attitude as the project progressed. Little successes led to larger successes and the smiles grew. Pre-tests were not used. The staff felt that if this population had been administered a pre-test on the concepts we planned to teach, then a large number would have withdrawn since it was a credit activity and a grade was assigned. Comments made by the participants on their final evaluations are our only recorded indicators of how their attitudes changed; these comments reveal that the participants developed a more positive attitude toward math and more confidence in their abilities as math teachers after this exposure.

3. To instill in each participant a confidence in his/her ability to do mathematics which will, in turn, lead to confidence in his/her ability to teach mathematics.

   The participants in both years' projects considered the content to be very difficult, with integers and rational numbers particularly traumatic.

They agreed that teachers do need to have more knowledge than that which they teach, but they were quick to remind the instructors that operations with rational numbers are not included in the curricula of the primary grades. In spite of their fear and apprehension at the beginning of the project, all participants successfully completed the course.

4. To develop and maintain a continuing relationship between the Mathematics Department of the University of Southern Mississippi and inservice elementary school teachers in our region.

Both projects included spring follow-up workshops. Although attendance at the 1981 follow-up workshop was poor, this experience was taken into account in planning the workshop for the 1982 group and more of the participants attended. One of the difficulties in bringing participants together for fo low-up activities is the fact that teachers in Southern Mississippi have no professional and/or personal days and Saturdays are very precious for them. Those teachers who live in the Hattiesburg area have contacted the director several times with requests to borrow materials. The requests have been granted. Dr. Dunigan has been asked to conduct workshops for Title I personnel in the region and has gladly done so. Until the state of Mississippi requires that the 160-odd school systems provide inservice education for their teachers, there will be limited interaction between the Mathematics Department of the University of Southern Mississippi and the teachers of this region. The project staff takes an active part in the Mississippi Council of Teachers of Mathematics but few classroom teachers are members. There are no state funds to help defray the costs of attending professional meetings and MCTM usually meets on Saturday. If it met on a weekday, attendance would be even poorer. If and when some of the financial difficulties of the state educational system are overcome, the participants will remember and will turn to the faculty of the Mathematics Department of the University of Southern Mississippi; and, we will be ready to help them.

| | | |
|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $29,591 | $34,264 |
| Discipline: | Mathematics | Mathematics |

# Marine Science for Elementary Teachers

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The need for inclusion of marine education in elementary and secondary school curricula is gaining wider acceptance as members of our society more fully recognize the benefits that can be derived from the wise management and utilization of marine resources. An educational program which takes for granted the world of water and its effects on human society in the proper perspective is incomplete and perhaps even misleading. A key factor in concrete implementation of marine education in the classroom is the classroom teacher. One cannot realistically expect classroom teachers to actively involve students in experiences related to the marine environment if the teachers either feel insecure about their competence in dealing with the subject area or have doubts about the relevancy of the subject area to their students. The marine education project entitled "Marine Science for Elementary School Teachers" was designed to address both situations, but with emphasis placed on the former situation, in a particular geographical locale, the Mississippi Gulf Coast area. Specifically, the objectives of the project were to provide an instructional program which:

1) familiarized teachers with the marine resources of the Gulf Coast;

2) aided teachers with instructional strategies appropriate for teaching marine concepts to elementary school students;

3) developed a cooperative and continuing effort betweeen the University and teachers in the target elementary schools;

4) made resources of the University available to the local schools; and

5) evaluated the effectiveness of the program to improve marine education.

The project embodied two phases: a one-week marine science workshop conducted June 2-26, 1981 and two follow-up meetings, one held in December and one to be held in May, 1982.

The marine education project involved teachers and supervisors, grades 1-6, from the elementary schools located along the Gulf Coast of Mississippi. Of the thirty participants, eighteen were classroom teachers, ten were special area teachers, and two were administrators. During the summer workshop session, the participants were involved in a variety of activities to familiarize them with the marine resources of the Gulf Coast: lectures, discussions, laboratory experiements, field trips, and environmental problem solving. Field trips were taken to the local beaches, local estuarine salt marshes, off-shore barrier islands, the Mississippi Sound, Gulf of Mexico, local industries, and state research laboratories. Laboratory experiments completed by the participants during the workshop were carefully selected so as to represent marine science concepts that might be appropriate for use in the elementary school classroom.

The initial follow-up session was held December 4-5, 1981. Participants were asked to share with their colleagues marine activities that they had used with their elementary school students subsequent to the June workshop. The overall quality of the presentations was excellent. Several participants had initiated quite innovative marine programs with their students. The individuals have each agreed to prepare an article for publication concerning their program. A second follow-up session is scheduled for May, 1982.

In furtherance of the objective to make the resources of the University available to the local schools, and to develop a cooperative effort between the University and the school systems, the University's arboretum was made available to all the target public and private schools for field studies. As part of their teaching strategy preparation, teachers developed mechanisms for utilizing the arboretum for field activities during the academic year. Three school systems used the facilities during the fall and others have plans for field trips during the spring.

Evaluation of the effectiveness of the marine science workshop was made up of two components: participant ratings of each of the activities (field trips, lectures, special activities and short activities), and assessment of anxiety level associated with teaching marine science (using the State Trait Anxiety Inventory (STAI)). The participants' ratings of activities were high, indicating that all structured experiences provided during the workshop were valuable for teacher participants and contributed in a positive manner toward their understanding of the marine environment. The STAI test results were analyzed by t-tests for dependent samples. Inspection of the results of the t-tests led to the following conclusions concerning the scores of project participants on the STAI:

a) there was a significant difference between pretest and posttest A-State scores. Teacher participants showed a significantly less amount of anxiety toward teaching marine science on the posttest than they did on the pretest.

b) there was not a significant difference betweeen pretest and posttest A-Trait scores. The mean level of trait anxiety of the group was hardly influenced by the treatment.

These results lead one to believe that a well-structured inservice training experience in marine science/marine education coupled with actual implementation of marine education activities in the classroom by teacher participants can have a pronounced positive effect in reducing anxiety toward teaching marine science.

Funding Year: 1981
Grant Amount: $15,094
Discipline: Marine Sciences

# Astronomy for Kids

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Elementary teachers in the state of Missouri are required to have only a minimal amount of science background for certification. Since most college and university teacher education curricula are tailored around state requirements, this usually means that prospective elementary teachers receive a minimum, or only slightly more than the minimum, science education demanded. Almost never does this educational background contain the subject matter of astronomy. However, one of the best ways of introducing children to science is to discuss the universe around them which they see regularly, such as the sun, the moon, the stars and their various motions and regular or seasonal changes.

For these reasons SMSU offered originally in 1979 an intensive four-week program for elementary teachers in the field of astronomy. The program was entitled "Astronomy for Kids" because the major objective was to instill in the teachers an enthusiasm for and understanding of astronomy which they could take back to their own classrooms. The 1980 program described here was a renewal and continuation of the original program of 1979.

The lecture-discussion portion of the program was a three-hour session four days per week aimed at providing each participant with a basic knowledge of the field of astronomy. The subject matter most in need of understanding, such as basic concepts of earth motion, seasons, lunar phases, twinkling of starlight, etc., were greatly emphasized. Particular attention was paid to providing descriptions of phenomena in terms which can be most directly relayed to children in elementary classrooms. This was considered very important since it is realized that elementary teachers often have difficulty translating an esoteric description of reality into a simple, understandable classroom demonstration.

In addition to those on the subject matter of astronomy, lecture-discussions were also given on the levels of understanding to be expected of elementary school children. Limitations on concepts which can be learned at various ages were defined and analysed in terms of the astronomical subject matter being presented. This was considered very important in helping to define the limits of what the participants should attempt in the classroom and the priorities they should give to discussing various astronomical subject matter.

The laboratory-workshop portion of the program was a two-hour session four days per week which gave the participants an opportunity to conduct experiments, to design and perfect classroom projects, and to interact with other participants in these experiments and projects. It was felt that these groups needed to be small in order for each teacher to have adequate contact with the faculty supervisor. It was possible for the teachers to take the results of many of these workshop sessions

directly back to their schools for use in their classrooms. Examples of these laboratory activities include daily drawings of the moon for a full monthly cycle, designing and building a sun dial which could be used in the classroom, and building a telescope with the use of simple lenses.

Twice weekly evening field trips to the university observatory were also held, to acquaint the elementary teachers with the important aspects of the night sky. It was agreed by the faculty in the program that the success of this portion of the program was beyond expectation.

Activities conducted during the follow-up portion of the program included monthly astronomical calendar and information mailings to participants, a fall review meeting of all program participants during the Annual Teachers Meeting held at the SMSU campus, and spring follow-up visits by the project staff to the participants' schools for observation, lecturing, and evening class star-parties.

The response of the elementary teachers to the project has been very positive. All participants, except two, completed the entire four-week program. Their anonymous evaluations indicated a great deal of satisfaction with the program and a determination to use what they had learned in their own classrooms. Follow-up visits to these classrooms by the program director and other associated faculty, have shown that approximately 85 percent of the teachers did successfully incorporate the material learned during the program into their classroom instruction in a major and useful way. Several of the remining teachers were not able to do this because of changes in their teaching assignments to non-scientific areas.

Funding Year: 1980
Grant Amount: $31,729
Discipline: Astronomy

## Economic Concepts for Elementary Teachers

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Phase I of Missouri's Economic Concepts for Elementary Teachers project was completed in August, 1981. One hundred twenty-five elementary teachers, administrators and specialists completed a series of intensive two-week summer seminars offered at five locations around the state which were designed to provide the economic information and teaching skills necessary for effective classroom teaching. Basic economic concepts, innovative teaching materials and appropriate instructional strategies for K-6 use were emphasized by the project staff consisting of highly respected economists and educators staffing the Missouri Council on Economic Education's network of university-based Centers for Economic Education.

During the course of the initial project phase, each participant designed activities to be field tested in his or her own classroom during the fall semester, 1981. The actual field testing of activities, which comprises Phase II of this project, will be completed by January 1, 1982. Each participant will then evaluate the success of his or her tested activities in cooperation with project staff and will submit an activity suitable for publication in a project activity book.

The culminating activity for the project consists of an economics fair to be conducted May 7-8, 1982. Project staff and participants from across the state will gather to exchange information, to view project displays and to receive additional information on how to teach economics in the elementary school. Each participant will receive a copy of the project activities book at that time.

Response to the project thus far has been excellent. Demand for project participation was heavy with nearly half again as many educators registered for Phase I as could be accepted. All educators chosen to participate in the project successfully completed Phase I and were awarded 3 hours of graduate credit from their host institution. Progress reports from project personnel working with participants on Phase II, the field testing of activities, indicate that the participants' enthusiasm for the teaching of economics remains high. Phase II is projected to be completed on schedule. The quality of activities already chosen for publication is excellent and plans for participation in the spring economics fair are underway in many schools. Spin-off activities from this project including presentations and in-service courses for other district teachers have been held or scheduled at all five sites.

Funding Year: 1981
Grant Amount: $53,970
Discipline: Economics

## Science for Elementary Teachers

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Three projects were funded at Kearney State: two two-week summer workshops in 1980, which trained teachers from Educational Service Units #15 and #16; a three-stage combination summer/academic year project in 1980-81 for teachers in the 8-county area surrounding York, Nebraska; and a combination project in the summer and fall of 1981 for teachers in ESU #7.

All the workshops covered topics in the fields of earth, life, and physical science. Participants learned science content as well as developed skills in process science, problem solving, and metric measurement.

Instruction during these projects involved much laboratory or "hands on" science experience. The Inquiry Role Approach was utilized in the earth and physical science areas. The laboratory style of instruction is aligned with the typical science program in many elementary schools in this area. Thus, the "hands on" style of instruction was well received by the participants.

One innovation utilized in these projects was a style of instruction called the Inquiry Role Approach (IRA). The IRA methodology involved participants working in three-member teams to solve science problems in a laboratory setting. Participants were very enthusiastic about this style of instruction (IRA), because the methodology appeared to:

1. build confidence in science;
2. make science enjoyable;
3. provide opportunities to develop process skills;
4. provide good interaction which aided in the understanding of principles and concepts of science.

The format for the summer 1980 workshop was modified from the proposed plan which funded forty participants for three weeks in one location, because a total of one hundred nineteen applied for the 40 openings. The advisory committee, composed of seven teachers, was consulted on this situation. They recommended the following changes: (1) use two locations - McCook and North Platte which would reduce the mileage considerably for most participants. (2) Reduce the workshop from three weeks to two weeks; thus, enabling more participants to attend the training. The Director analyzed the budget to determine if it was feasible to make these changes. By using two locations, the mileage per participant was reduced sufficiently to accept a total of ninety participants. This change required a double session in North Platte to accommodate sixty participants. The teaching staff was consulted and consented to assume an added work load in order to accommodate the enthusiastic elementary teachers who applied in such great numbers.

This project was evaluated by using a questionnaire. Information on four major categories was solicitated: (1) class procedures, (2) instructional characteristics, (3) value of course, and (4) effectiveness. The results of this evaluation reveal strong participant satisfaction with the project.

A total of eighty-eight participants attended and completed the summer 1980 project.

The 1980-81 combination summer/academic year project had 40 participants in the one-week summer workshop; these teachers, plus an additional twenty-five, completed thirty evening sessions in a modular schedule during the following school year. When it became clear that participant costs were less than budgeted, these funds were used to extend the training to 18 additional teachers, for fifteen of the evening training sessions. Overall, 83 teachers were trained in this project. In addition to the participant questionnaire, pre- and post-tests were given, using the Sequential Tests of Educational Progress Science Form 1A and the Processes of Science Test. These showed a gain in science knowledge and in the use of process skills.

The project serving ESU #7 trained 36 teachers in the summer session, twenty-nine of whom continued in the six evening sessions held during the fall of 1981. The evaluation of this project used the participant questionnaire referred to above, with similar results.

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| Funding Year: | 1980 (Summer) | 1980 (Combination) | 1981 |
| Grant Amount: | $19,322 | $26,900 | $19,367 |
| Discipline: | Interdisciplinary | | |

## Microcomputers and Computer Aided Instruction for Intermediate Teachers in Educational Service Unit #10

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The program, consisting of fifteen sessions, began in September and continued through December 1981. Thirty teachers of the intermediate grades were involved during this time and a different thirty were involved in the sessions to be conducted from January to May of 1982.

The courses were offered to introduce intermediate teachers to computer assisted instruction. The participants had hands-on lab experiences where they learned how to use a microcomputer, reviewed and evaluated computer assisted instruction materials, made modifications to existing software, learned how to porgram using the BASIC language, and learned to use an authoring system program. In addition, they became more computer literate by discussing computer terms and jargon, reading the history of calculating devices, researching and discussing applications in and effects on society in general, and education in particular, and examining games, periodicals, and other materials that could be used in their classrooms. Their final project was to develop software for their classrooms.

Funding Year: 1981
Grant Amount: $26,094
Discipline: Computer Sciences

## Teacher Workshop in the Natural Sciences

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The Teacher Workshop in the Natural Sciences held at the University of Nebraska State Museum in July, 1981, brought together teachers from various parts of the state to study elementary science with research scientists. The class included teachers who ranged from complete scientific novices to reasonably knowledgeable individuals. All were enthusiastic participants and all gained a great deal from the experience. Both professors and students were highly pleased.

The workshop lasted for three weeks. The first four days of each week were devoted to scientific sessions; the last day to curriculum development under the guidance of a professor from the Teacher's College.

There were units in Anthropology, Botany, Entomology, Geology, Invertebrate Paleontology, Zoology, Vertebrate Paleontology, Health Sciences, and Astronomy. Each scientific session ran one to two days, dependent in large part upon whether or not there was a field trip. Generally each session was composed of three 1/2 day sections: 1) classroom lecture and demonstration; 2) field trip; and 3) laboratory session based upon field trip materials.

Throughout the workshop, research scientists stuck to hard science, though necessarily at an elementary level. Contrary to advice which I had received on all ideas, we did not water down content to demonstrate teaching devices that they could use in the classroom. We were the scientific experts; they were the elementary teachers. Our job was to communicate basic information to them; their job was to rework it for their classrooms. To judge by the curriculum materials which they developed, they did it beautifully!

Participant evaluations were uniformly positive. Scalar devices ranging from 1 (poor) to 5 (excellent) were used to evaluate content, materials, field trips, time allotment and level of content for each of the seven program areas. Of 35 scores, only one was less than 4.0. That was a 3.6 when students felt that the level of content was too high in one program area. Participants also felt that the amount of time spent on each subject area was about right, except that one program area was too short.

Funding Year: 1981
Grant Amount: $27,198
Discipline: Interdisciplinary

## Pre-college Teacher Development in Earth Science

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The purpose of the project was to promote and support earth science education at the elementary school level in the Southern Nevada area, through the use of lectures, labs, and extensive field work.

Over a period of five months, intensive classroom lecture, laboratory, and discussion sessions concentrated on developing an understanding of earth science concepts and their application in the classrooom. Nine completed and four additional days have been and will be utilized for field observations. The initial field trip to Zion National Park initiated observational skills and the concepts of lateral continuity, superposition, original horizontality and uniformitarianism. The simple geology of Zion was followed by a local field trip to bring the known geology to our local region of greater complexity. Field work was extended to the Grand Canyon, and additional local field areas to extend the complexity of observations and understanding. After completing one semester of class work, field observations are to be extended to Death Valley National Monument, where extremely complex folding and faulting challenge the students and faculty alike. Urban geology and the geology of school yards will be discussed in class and examined on a field trip during the second semester.

During the spring, emphasis in the classroom will shift to teaching methods and materials. Each teacher will create a classroom project which utilizes earth science concepts. The co-directors will visit the classrooms to observe, advise, and assist the teachers in their classroom activities.

In May, a two-day workshop will be held at Echo Bay, an isolated geologically scenic locale, an hour from Las Vegas. Teachers will bring their class projects to the workshop, and for two days the applications of the institute will be shared among the group. The final session will be devoted to a critique of the workshop.

The project's goal is to give information and geologic confidence to interested and dynamic teachers, to help them apply their knowledge to the classroom, to assist them in acting as "sparkplugs" to help disseminate earth science "excitement" to other teachers in their schools, and to enjoy our experience. The three instructors agree that each of these goals were satisfied the first semester, and anticipate the second semester's activities will continue to promote these purposes.

Funding Year: 1981
Grant Amount: $27,604
Discipline: Earth Sciences

## Physical Science for Elementary School Teachers

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This project is providing 33 elementary school science teachers from the Southwest New Mexico area and Southeast Arizona area with the necessary theoretical and methods background to teach physical science creatively and effectively.

The course, titled "Physical Science for Elementary School Teachers," is meeting on alternate Saturdays from 9 a.m. to 4 p.m. in the Science Building at Western New Mexico University during the academic year 1981-82. The areas of physical science to be covered include physics, chemistry, astronomy, and geology. A field trip, showing the teachers how rock specimens should be collected, labeled and identified, will take place during the last class meeting. Classes consist of lecture, demonstrations and laboratory workshops. The subject matter content of the course has been closely related to, and as much as possible, correlated with, the subject matter of the textbooks currently used in the elementary schools participating in the project.

The teaching of science for inquiry has been stressed and emphasis is placed on a number of methods of teaching physical science that require investigative procedures by both student and teacher. Creativity has been suggested through many open-minded experiments, problem solving activities and independent study under faculty guidance.

Cooperative relationships between Western New Mexico University and participating schools will be actively maintained after completion of the course. The project director and instructor will assist each school in developing a laboratory resources center and a science inservice training program.

Response from participants to date has been very positive and enthusiastic. Many comment that they no longer have a fear of teaching physical science to their students. There is some evidence that the course is indeed having a positive impact. For example, during the recent high school, junior high, and elementary school science fairs, a comparison was made of the number of biology projects versus physical science projects. The high school projects were approximately 85% biology and 15% physical science. Junior high was approximately 50% biology and 50% physical science. (Note: A course "Physical Science for Junior High Teachers" was sponsored two years ago by Western New Mexico University and the National Science Foundation.) The elementary school projects were approximately 20% biology and 80% physical science, demonstrating the strong influence of the physical science course at Western New Mexico on the local elementary school science teaching.

Funding Year: 1981
Grant Amount: $30,103
Discipline: Physical Sciences

## Mathematics: A Problem-Solving and Application-Oriented Approach

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The Project, "Mathematics: A Problem-Solving and Application-Oriented Approach," provides 35 teachers of capable and gifted children (grades 1-4) with a year-long workshop/seminar program designed to strengthen their mathematics background and to give them experience in solving problems and using higher order thinking processes in mathematics and science. A variety of instructional formats are used including: hands-on workshops, problem solving seminars, learning centers, field trips, and investigatory projects. These formats reflect current thinking about approaches for teaching capable and gifted children. The Project supports participants in implementing problem solving and application activities in their classrooms through school visits by Project staff, individual conferences, loan of portapaks (classroom sets of materials and activity sheets), learning centers, and orientation session for principals to encourage their support of teacher innovation.

The Project provides a 4-credit graduate course (24 sessions over 2 semesters), offered jointly by the School of Education and the Department of Mathematics at Brooklyn College. The major topics which are dealt with include: Numeration, Operations, Informal Geometry, Number Theory, and Probability. These topics are treated in conjunction with related applications in the sciences. Problem solving and other higher order processes are stressed in both mathematics and science activities. Emphasis is placed on adapting activities for classroom use. The Project's blend of content, process, and approaches to teaching will enable participants to implement an enriched mathematics curriculum for their students.

It is expected that, as a result of the program, participants will strengthen their mathematics backgrounds, develop problem solving and other thinking skills, and improve their attitudes toward the nature of mathematics and their abilities to engage in problem solving. It is also expected that participants will share their knowledge and experiences gained in the program with other teachers in their schools, thereby multiplying the effects of the Project. In addition, products developed by the Project and by participants (e.g., booklet of activities for the classroom, Portapaks, slide-tape on problem solving in the classroom) will be available to other teachers, thereby benefiting the teaching community at large.

Funding Year: 1981
Grant Amount: $35,920
Discipline: Mathematics

# An Interdisciplinary Approach to the Study of Environmental Science for Elementary School Teachers

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This project was a cooperative effort involving The College of Staten Island, the Staten Island Cooperative Continuum of Education, High Rock Conservation Center, and Community School Board 31 of the New York City Board of Education in an effort designed to increase significantly science subject matter knowledge of sixty-three elementary school teachers.

An interdisciplinary approach to the study of environmental sciences emphasized selected concepts of biology, chemistry, ecology, and physics within this framework. Six major themes were investigated during the twenty-two full day sessions held during August 1980, and the following academic year. These themes were designed to break the pattern of compartmentalization in science teaching to which the teachers had been exposed in previous formal science courses.

These themes were as follows:

Theme I - Objects and Systems: Both biological organisms and physical substances are investigated in terms of their structures and organizational framework.

Theme II - Interactions of Matter and Forces: Chemical, gravitational, electromagnetic, and nuclear forces in biological and physical systems.

Theme III - Motion, Energy and Structure: Motion of particles and cells, kinetic energy, chemical equilibrium, energy transformations, cellular processes.

Theme IV - Space, Time, and Change: Origin of life, Evolution, Genetics, Thermodynamics, relativity, interrelations of physical phenomena.

Theme V - Description and Prediction of Behavior in Organism and Particles: Heredity, Molecular Basis of Genetics, DNA, Population Genetics, Laws of Thermodynamics, Radioactivity.

Theme VI - Interrelationships in the Man-made and Natural World: Field Study of the Environment and Ecological Phenomena, Populations, Communities, Ecosystems.

Each theme was developed through twelve hours of lecture-demonstration-discussion sessions in the classroom. Four hours of laboratory work for each theme was

correlated with the content of the classroom meetings. Field experiences were conducted at the High Rock Conservation Center (five three-hour sessions in August 1980), the Staten Island Zoo, and Gateway National Park (one three-hour session at each site).

The effectiveness of the Institute was measured by several instruments. Participants successfully completed written examinations measuring knowledge of the scientific concepts studied in the program. They also demonstrated the specific performance skills required in conducting laboratory and field investigations. Participant appreciation of the relevance of environmental science was revealed by individual written reports dealing with environmental issues of local concern. Additional evidence of the effectiveness of the Institute in the affective domain was indicated in anonymous open response feedback forms. The overwhelming feeling of the participants was that the Institute was a highly valuable learning experience, and, one which would greatly influence both the content and method by which they teach elementary school science.

Funding Year: 1980
Grant Amount: $47,673
Discipline: Interdisciplinary

## Pre-College Teacher Development in Energy and Energy Conservation Education for Elementary Science Teachers

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The objectives of the project are: 1) to improve the subject matter knowledge of elementary school teachers of science in the area of energy conservation in order to create a cadre of well trained scientific professionals in energy conservation education within well situated elementary schools within New York State; 2) to improve teacher capability for communicating and demonstrating energy conservation information and experiments in the classroom, and to stimulate both the infusion of the subject matter into regular elementary science classroom practices and the communication of energy conservation information and leadership within elementary schools generally; 3) to encourage the effective transfer of knowledge in the field of energy conservation from university scientists to elementary school science teachers, and to further the development of permanent professional relationships between educators at the university and elementary school levels; and 4) to improve teacher awareness of appropriate instructional strategies in energy education and to assist teachers in the identification and use of appropriate instructional resources.

The program was open, by application, to all New York State elementary teachers, grades 1-4, and consisted of two-week-long conferences (July, 1981) plus an extended program of curriculum materials development, classroom pilot-testing and a two-day feedback/evaluation session (April, 1982)

The conference was designed to emphasize the methodology and science content necessary for developing curriculum activities related to energy conservation education and included a series of lectures, workshops, field trips and small group discussions organized around the following topics:

... Basics of Energy Conservation Education
... Basic Energy Principles and Concepts
... Designing Classroom Activities
... Energy and the Built Environment
... Solar Energy/Wind Energy
... Non-Solar Alternate Energy
... Energy and the Weather
... The Economics of Energy
... Energy and the Natural Environment
... Teaching Resources for Energy Education

During the fall and early spring, project participants have designed and tested energy conservation curriculum materials and activities in individual classrooms. Reports on these efforts will be presented and discussed at the April follow-up session. Those materials and activities which are evaluated as having proved successful will be included in an activities manual which will be distributed to all participants as well as placed on micro fiche and made available to all elementary science teachers within the state.

During the course of the project, a Newsletter was begun by a number of program participants in order to further increase the sharing of ideas and information among the group. At the conclusion of the project, basic project materials will be collected and included in a Resources Manual which will be made available to the New York State Education Department for their use in encouraging the further development on energy education at the elementary school level.

Funding Year: 1981
Grant Amount: $25,525
Discipline: Energy

## Science with Mathematics for Elementary School Teachers

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The faculty of the Graduate School of Education of Fordham University at Lincoln Center, New York, have, in collaboration with New York City school districts, designed a program of Saturday workshops devoted to the teaching of reading skills using math and science texts for 30 elementary school teachers to be offered during the Fall 1981 semester. Four follow-up sessions are to be held during the Spring 1982 semester.

Based on an assessment of teacher and student needs and an overall awareness of the shift away from science and mathematics education in the elementary schools, the proposed workshops are designed to incorporate the disciplines of science and mathematics into comprehensive, hands-on teaching and learning activities for grades 4 through 6. The Saturday workshops are aimed at extending the basic subject matter knowledge and teaching competencies of the teachers involved by emphasizing an interdisciplinary approach to teaching science and mathematics.

Two particularly successful features of the project were a seminar at the Hayden Planetarium which was conducted exclusively for project participants, and a field trip to the New York City Fire Boat House in which project participants were encouraged to do hands-on experiments combining environmental science and energy conservation.

In addition to the Saturday workshops, school personnel will have continued access (beyond the term of the grant) to the two Research/Learning Centers already established which will be equipped with many of the materials utilized during the workshops. Through on-going support evaluations of teaching strategies and materials, and a commitment on behalf of the faculty and administration of Fordham University and the administration and staff of the school districts involved, it is expected that participation in these workshops and access to the Resource/ Learning Centers will lead to a continued cooperative relationship between the elementary school teachers of the participating districts and Fordham University's Graduate School of Education.

Funding Year: 1981
Grant Amount: $23,463
Disciplines: Math, General Science

## Increasing Science Competence: ISC

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The goal of this project is to improve elementary school teachers' cognitive knowledge in the sciences and to help them utilize these concepts in developing activities and materials suitable for the effective teaching of science as an inquiry process.

The project has been structured around two phases. Phase I was the summer session, at which 30 selected elementary school teachers from the Stamford, Connecticut School District met all day, 5 days a week for 3 weeks (15 sessions). These sessions were devoted largely to teaching science content in a framework of methodology, with the emphasis on the physical sciences. By the end of the summer most participants had lost their fear of physics and chemistry and had found that the satisfactions could be immediate, and that teaching science could be fun. Content areas were related to the area of biology, when possible, and the viewing of television productions such as Nova, Cosmos, The Ascent of Man, and Survival were encouraged and used as the basis for class discussions.

Phase II of the project, during which the group meets on 15 Wednesday afternoons from October-June, focuses upon implementing methods for conveying content to the students at the various levels of the elementary school. At each session participants bring in activities for their "show and tell," informally vying with one another to demonstrate the most spectacular experience using simple homemade materials. These demonstrations are the springboard from which the staff conduct an in-depth presentation of content and illustrate methodology.

An independent evaluation of Phase I of the project, conducted by the Stamford Board of Education, concluded that the workshop was successful in terms of both the goals set by the teacher participants as well as those set by the staff. The Board of Education will conduct a similar evaluation at the conclusion of Phase II of the project.

Funding Year: 1981
Grant Amount: $35,550
Disciplines: Biology, Chemistry, Physics

# The Use of Microcomputers in the Special, Elementary, and Junior High Classroom

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The goals of this project were to introduce teachers of special education classes and of grades one through nine to computer-assisted instruction, to develop the teachers' skills in creating software suitable for use in their classrooms, and to teach them to adapt available commercial programs for classroom use. One class session was devoted to a lecture and workshop in diffusion theory which was designed to prepare the participants to act as change agents in introducing computer-assisted tutorials and games into their district schools. Instruction and assistance was provided by college faculty in mathematics computer science and special education, by an area elementary school teacher and a junior high school teacher, and an undergraduate mathematics major.

The two-week workshop, consisting of 10 sessions each three hours long, was offered three times in the summer of 1980. A total of 86 teachers participated, of whom 25 were special education teachers, and 34 were teachers in inner-city schools where the students were from predominately minority ethnic backgrounds.

In the fall, after the summer workshop sessions were concluded, a questionnaire was sent to principals of all elementary and junior highschools in the target area, and 93 percent of those knowledgeable about the summer workshops agreed strongly that they were valuable in the exchange of ideas for program applications. Pre and post tests showed an increase in computer literacy and in the appreciation for the potential of computer technology applied to education among the participants.

Additionally, the project established an on-going resource center on microcomputers and educational software to serve 22 local school districts and agencies. The programs created by the summer participants were available for review and copying, and commercial programs could also be reviewed at the resource center. The also conducted on-site workshops and demonstrations at 17 schools in the area. Through these site visits, many more teachers (197) and administrators (6) became familiar with the potential of microcomputer use in the classrooom and the commercial and workshop-created programs. In addition, approximately 70 elementary school students were involved in 3 different on-site follow-up workshops.

Funding Year: 1980
Grant Amount: $18,564
Discipliens: Mathematics/Computers

## Overcoming Barriers to the Teaching of Physical Science

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Most elementary school teachers today lack a strong foundation of knowledge and understanding of the facts dealt with in the physical science units they must teach to their classes. As a result, they have little confidence in their own ability to teach these units and will often avoid doing so. Discussions with teachers and examination of elementary school curricula show that, where science is taught, it is almost entirely in the biological areas.

This indicates that there is a need to expand the knowledge base of the teachers and to practice teaching strategies with them in order to give them the confidence to deal with these units. The project addresses the problem by identifying a key group of teachers to participate in a year-long teacher development workshop in science at Pace University, being conducted during the 1981-82 school year, following a one-week summer session. Classwork is a blend of content and teaching strategies with much demonstration-laboratory work. By providing opportunities to practice teaching these concepts at the elementary schools, it aims to increase the elementary teacher's confidence in his or her own ability.

The 21 key teachers were selected from three Teacher's Centers in the local area and share the expertise they gain in the workshop with their fellow teachers through in-service opportunities arranged by the Center. The close relationships built in this manner between Pace faculty, the workshop participants and the teachers in the districts involved provide a strong, continuing support system which is intended to increase the amount of physical science taught to the children in the schools of the participating teachers.

Since the program continues until May 1982 there is not summative evaluation data available at this time. However on the last ongoing formative evaluation, in November 1981, almost everyone of the teacher participants reported that:

1) They have become very excited about the subject. They are placing more time and more emphasis on science within their own classes. They've been teaching new units and are more comfortable with the subject in general.

2) They feel more creative in their own teaching since they've begun incorporating what they've learned in interdisciplinary units.

3) They've begun to share their learning with other teachers. Two are attempting to start science fairs in their schools. One is investigating the possibility of starting an elementary education teacher training program in science on a local cable TV program. Three have started or joined existing school science teams. One has started a science club.

Funding Year: 1981
Grant Amount: $24,629
Discipline: Physical Science

# Add Intuition to Math, Substract Anxiety

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The objective of this project is to improve the quality of mathematics instruction at the elementary level (K-6) by strengthening the effectiveness of elementary school teachers in three related areas:

- Increased knowledge and understanding of subject matter on the part of the teachers.
- Greater teacher confidence in his/her own mathematical intuition.
- Heightened teacher awareness and sensitivity to manifestations and sources of "math anxiety" in his/her students.

The course is organized around two central ideas:

1) since imagination and intuition are the prime sources of invention and development in mathematics (as in any other field), mathematics content can best be understood and taught by emphasizing these qualities and encouraging them in students; and

2) since a great many people (including teachers) experience substantial discomfort and lack of confidence about mathematics, then focusing on this block to learning, early in the course and in a deliberate way, should relax the participants' anxieties about mathematics and open them to a richer learning experience in the subsequent mathematics modules.

The project was offered in both the 1980-81 academic year and again in the summer of 1981 and academic year 1981-82. Forty-one students began the 1980 program; twenty-eight of these completed the full course which was made up of 30 two-hour meetings. The participants were generalists rather than math specialists, from public and private schools spread over a large (6-county) area.

In the 1980 project, the first few sessions (eight hours for each participant) were spent in small-group workshops devoted to "Math anxiety". Each workshop had thirteen or fourteen participants plus an experienced group leader. The bulk of the course (fifty hours) was devoted to mathematics content, divided into modules (or mini-courses) in concepts in arithmetic and algebra, creative problem solving, introduction to probability, applications of calculators, and intuitive geometry. These subjects were chosen and treated so as to emphasize a) a real-world sources of mathematical ideas and rules and b) the role of imagination, intuition, and guessing in the solution of problems. Special attention was given to developing examples which could be brought back to the classroom.

With reference to the major goal, helping the participants to feel more comfortable with mathematics and confident in their own abilities, the course appears to have been highly successful. This was indicated by discussion at the last session,

comments in an end-of-course questionnaire, and dramatic changes in scores on the MARS (Math Anxiety Rating Scale) test, administered at the first and last class meetings. There was also a common feeling among the participants that they had become much more aware of manifestations and causes of math anxiety in children, though several people expressed the opinion that not enough class time had been devoted to techniques for easing pupils' math anxiety.

This comment and others were taken into consideration in planning the 1981 project. In order to have a wider impact, the current course was offered to teams of 3 or 4 "key" teachers (preferably including an administrator) from ten schools in the region. The majority of the instructional activity was placed in an intensive two-week summer class, so that, when school began in September, the members of each team had shared a common intensive educational experience, which formed the basis upon which they could begin, as individuals, to try out some of the material in their classrooms and, as a group, to plan for the inservice course they would offer in their home schools. Subject matter changes incorporated in the current project included the following: the arithmetic module is shorter; problem-solving is now a continuing theme, given some attention in every session, rather than being treated in a special module as if it were a distinct discipline; the module on hand calculators has been lengthened to include such applications as compound interest, annuities, and amortization tables; a longer geometry module now builds upon hands-on materials, in particular, the geoboard.

There are forty participants enrolled in the current project.

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|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $31,181 | $41,095 |
| Discipline: | Mathematics | |

## A Regional Resource Center for Elementary School Teachers

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The overall goal of the project at SUNY/New Paltz has been to increase the number of Elementary Science Program (ESP) units available in the Putnam/Northern Westchester region from seven to thirty-five and the number of teachers trained to use them from twenty in 1979-80 to sixty-five in 1981-82. Related to this goal are the following objectives:

1) To improve teachers' knowledge of science and their skill in teaching elementary school pupils in the region through the use of the Elementary Science Program (ESP).

2) To increase communication and cooperation between the State University College at New Paltz and the public schools of Putnam/Northern Westchester Counties.

3) To aid teachers in the identification and use of resources helpful in teaching scientific concepts in the ESP units.

The ESP uses kits developed by ESS and SCIS, which incorporate such non-formal features as a hands-on laboratory approach which is child-centered, individualized, flexible, and interdisciplinary, emphasizing the skills of scientific procedures.

The project was conducted from July 1981 to June 1982 at a regional Science Resource Center established by the Putnam/Northern Westchester BOCES in Yorktown Heights. The two-week summer course in July 1981 was followed by an academic year program of seminars and regular supervision of local instruction from September until June 1982. During the two-week summer college course, in addition to gaining familiarity with the activities the teachers were to use in their classroom, they also received in-depth training in the scientific concepts basic to each unit as well as extensive training in the management of their classrooms in the use of the ESP science units.

The project director and two staff members came from the College at New Paltz; two educators from the public school sector also assisted in conducting the classes. One of these served as project coordinator and has provided continuous consultant support to the participating teachers during the school year.

As a result of the project, many school districts have adopted or plan to adopt the ESP kits for the 1982-83 school year. Specific data on these adoptions is available from the Project Director.

Funding Year: 1981
Grant Amount: $24,987
Discipline: Interdisciplinary

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*Funded jointly by the Department of Education and the National Science Education.

Workshop in Law-Related Education

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The basic goal of this workshop has been to encourage the implementation of law-related education in social studies classes on all grade levels. The means for achieving this goal centered on workshop sessions held for three weeks in July 1981, aided by follow-up visits from the project staff during the school year, and two group reunions, one in November and one scheduled for May 1982.

The training focused upon providing participants with knowledge of legal and procedural concepts, acquainting them with available materials in law-related education, and training them in development strategies for modifying their own classrooms, with special emphasis on adapting materials and concepts for elementary school children.

Although the original intent was to draw participants from system-wide teams, consisting of elementary and secondary teachers and administrators from each school district represented, this proved difficult to achieve. Only 10 of the participants were parts of such teams and the rest were the sole representatives of their respective districts. As a result, it was not possible to meet the initial goal of influencing system-wide implementation of law-related education; nevertheless, in most cases the individual participants were successful in influencing their own school programs.

Other than that drawback, the rest of the program met with enthusiasm, generated great interest, and has produced some exciting results. The Summer Workshop sessions accomplished all that had been hoped, and offered a number of field trips and field experiences that were most valuable. Among these were participation in the New York City Police Department's Civilian Observer Program, wherein participants were allowed to accompany police officers on their regular daily duties, and an enlightening and sobering visit to Rikers Island.

Armed with the training received at the Summer Workshop, participants began the 1981-82 academic year at various levels of law program design, and as the project staff continue visiting classes, they have been impressed with how each participant has adapted the training to his or her own needs. In fact, interest in law-related education generated within the College by the 1981 Workshop resulted in the development of an enrichment course, called "The Law in Action," being offered to area students on Saturdays during the fall and spring semesters and being taught by the Project Associate. The success of the Workshop is also attested to in the remarks contained in the participant evaluations and questionnaires. From the most successful of these ideas, the first reunion program was designed.

At the Fall Reunion, several participants described their programs and demonstrated materials and methods they had developed for their classes. In addition, a representative of the New York City Children's Services Department spoke about family law issues, with special emphasis about child abuse in the classroom. A videotape of the Summer Workshop activities entitled "The Law in Action" was shown at the conclusion of the reunion.

A spring reunion and continued publication of the project newsletter, The Legal Eagle, are planned as further means of maintaining the network of sharing ideas and alerting participants to the latest developments in the field and the successes of their colleagues.

Funding Year: 1981
Grant Amount: $27,939*
Discipline: Social Science

* Funded jointly by the National Science Foundation and the Department of Education.

# Experiences in Biological Field Research and Island Ecology

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Twenty North Carolina science teachers and teachers of elementary gifted and talented programs joined four Bahamian science teachers in a ten day field experience on Andros Island in the Bahamas in the summer of 1981. The staff of the institute were from three museums and two universities. The program included actual research projects on the flowering patterns in some tropical plant species, a major paleontological dig, collections of the little-studied snail fauna, and field investigations on the status of the endangered Andros Island iguana, Cyclura cyclura. The goal was to give the teacher participants insight into how real scientific investigations are undertaken, and to teach basic field and laboratory techniques through such activities as terrestrial and underwater transect studies, visits and studies in cave and coral reef ecology, and mark and recapture population and behavioral studies on lizards and hermit crabs. In the evening lecture sessions, teachers learned how to compile and analyze data and how to interpret their experiences into actual activities they could use with their students on field trips and in the school laboratory.

Teachers were asked to develop a teaching unit or series of activities that used scientific techniques and, where possible, field experiences using the methods they learned on the island. In November, each teacher prepared a written description and evaluation of his or her project and presented an illustrated, oral presentation of these activities to the entire group. The staff and participants prepared written evaluations of each project. The teachers were also asked to evaluate the institute twice, first on the completion of the field trip and again at the conclusion of the follow-up seminar.

The results of the institute can be measured in several ways: the scientific work accomplished by the group on the island; the impact of the experience on the overall teaching methods of the teachers; and the changes in the enthusiasm of the participants and the impact this had on the other faculty, administration, and communities where the teachers worked. The staff felt that the scientific impact of the research conducted by the participants is substantial, and is putting together a large report of the results, including a paper on the pollination dynamics of Canella alba. The vertebrate fossils collected, along with those collected prior to this trip, make up the largest and most significant collection in the Bahamas to date. Equally important to the scientists analyzing them are the data collected on the herpeofauna and invertebrates.

Staff evaluation of the projects presented by the teachers indicate that most participants have made significant changes in their classroom techniques, both in factual terms of the information absorbed and in confidence gained in their scientific abilities. Participants in the

institute have generated at least 11 news articles in local newspapers and four have given talks to their PTA's, civic organizations and faculties. Three teachers have conducted faculty workshops in their districts and three have developed programs that the project director will work with to produce papers to be submitted to NSTA or NABT journals.

Funding Year: 1981
Grant Amount: $14,482
Discipline: Biology

## Exploring North Dakota's New Geography for Fourth Grade Teachers

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Western North Dakota is being impacted by energy development, particularly lignite mining, but few people in eastern North Dakota are aware of the magnitude of changes of land use in that area. In an effort to provide fourth grade elementary school teachers with improved background on regional geography for teaching the state-sponsored course on North Dakota, a summer seminar was provided at the University of North Dakota by faculty from the Department of Geography and the Center for Teaching and Learning.

Between June 1-5, 1981, thirty-five (35) teachers attended on-campus seminars related to settlement, population shifts, natural resources, economic geography, land use changes and planning issues in North Dakota focused on consequences of energy development. A portion of each classroom day was spent in reviewing teaching materials, teaching strategies, and developing take-back items which will aid in teaching geographic concepts to fourth graders in North Dakota regional studies.

A two-day field trip to western North Dakota followed the three-day classroom session, to provide "first-hand" exposure to changes going on in that area. On this field trip, teachers visited Carrington to hear a presentation on irrigated agriculture and the Garrison Diversion project, had a briefing at the State Capitol on energy development impacts, and attended a special session at the North Dakota Heritage Center (State Historical Society) on Native American settlement/housing issues. The second day was spent along the endangered Missouri River bottoms, at the Falkirk Mine (major lignite strip mine and coal-fired electric generator facility) and in energy-impacted communities such as Washburn, Hazen, and Underwood.

One of the project goals is for the teachers to be able to continue the cooperative relationships developed during the summer by preparing statewide geography in-service programs and by developing smaller versions for their respective elementary schools. These latter activities were scheduled to be presented in October and November, 1981 and spring of 1982. Ultimately, fourth grade pupils will be the beneficiaries of this continuing education of elementary school teachers in geographic study of North Dakota.

Funding Year: 1981
Grant Amount: $18,430
Discipline: Geography

# High Interest Science for Teachers of Gifted and Talented

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During the summer of 1981, two summer workshops of one week each were conducted on the campus of East Centeral University, in High Interest Science for Teachers of Gifted and Talented Students in grades K-4. Each workshop session had 37 teachers in attendance. Teachers participated in hands-on activities and classroom experiences in the content areas of Astronomy and Space Sciences, Flight, and Environmental Sciences. In addition to these content areas, the participants received specialized instruction in techniques for promoting lateral thought, working with gifted students, and in implementing hands-on curriculum. Participants were given the opportunity of reviewing relevant curriculum presently available and were given copies of many curriculum guides which can be obtained without cost. Resource people were brought into the classroom for specific presentations on a variety of topics including science curriculum, gifted programs, microcomputers, and environmental science.

In addition to the regular classroom work, participants went on a one-day field trip that included total immersion in environmental education concepts and curricula, participated in a half-day rocket launch and kite flying contest, and attended a night astronomy session where they were able to view many of the planets and star clusters through telescopes. During the last session, particpants were able to watch an eclipse of the moon during the viewing session.

Optional activities were made available each evening of the program. These included such things as: a night hike to become familiar with the night sounds and night life present in an oak forest, a trip to a fish hatchery and Ten-Acre rock, and the opportunity to go fossil hunting.

During the program, participants were briefed on expectations regarding the preparation of an implementation plan. These plans were submitted by the participants after they had had time to examine the wealth of curriculum materials they had been given and to determine the way they felt they could implement ideas they had gained during the session. Participants were able to earn three graduate hours from the one-week course, after successfully completing their implementation plans.

Follow-up sessions have been held and numerous visits have been made to the schools of the participants. We began to receive letters requesting that we visit schools almost immediately after the completion of the program. In all cases, the teachers have requested that we present workshops to the other teachers in their buildings as well as visit their classes. These have been very rewarding experiences, both for the project staff and the teachers.

The success of the program has exceeded even our expectations. The enthusiasm of the participants never waned throughout the program, even though we were going from 8:30 a.m. until 4:00 p.m. each day with optional activites until late in the evening or early morning. Over half of the participants attended all of the

optional activities in each session and many more attended at least one of the optional activities. The curriculum plans that were submitted reflected a continuation of this enthusiasm even after the program was completed. Even this far into the school year, we are still hearing from the teachers about how excited they are about the program. We are receiving many inquiries about the availability of a similar program for the upcoming summer.

The success of the program is probably linked to several factors. One of these factors is that we were offering a program for teachers of the gifted - something that is not available at very many universities. In addition, we gave the teachers the opportunity of earning three hours graduate credit in a very compressed, intensive, one-week program, which freed them to attend other programs during the summer and still have time to prepare for the school year that was coming up. An additional factor was recent Oklahoma legislation that was passed mandating that every school system in Oklahoma implement a program for the gifted students of their district, and that the teachers who would be involved would have had some training in working with gifted students. These factors, combined with the fact that we were working with elementary teachers, contributed in large measure to the success of the program.

Funding Year: 1981
Grant Amount: $35,928
Discipline: Interdisciplinary

# Concept-Oriented/Laboratory-Centered Science for Elementary Teachers

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This project was designed to help pre-college elementary teachers gain a better understanding of the concept-centered, laboratory-based approach to teaching science so that they would institute science activities in their schools. The specific project objectives were:

- To provide elementary teachers with experiences with science concepts which are compatible with the understandings of elementary school children.
- To lead teachers to learn science concepts through experiences based on the content and process structures of science.
- To provide elementary teachers with analysis skills for assessing the appropriateness of science concepts for their students' developmental level.
- To provide a learning model which will lead to an instructional model that is compatible with science.
- To encourage elementary teachers to use an activity centered approach to teaching science.
- To acquaint elementary teachers with activity centered materials available for teaching elementary school science.

The project plan was to instruct the participants in science in exactly the same manner that the project staff believes the participants' students should be instructed. The study for each concept began with an extensive guided laboratory exploration phase in which data was taken. The concept was then introduced or invented during a discussion. This was followed by an intensive period of study seeking the utility and generalness of the concept through readings, demonstrations and other lab activities. This approach has been called the "Learning Cycle Approach", an approach to learning science concepts which, it was felt, would provide teachers with a useful teaching tool.

Participants met for four hours each day for four weeks. Each day they experienced three types of activities. Activity Type 1 was the discussion of the unique role of science in the elementary curriculum, developmental theory, and the learning cycle. Activity Type 2 was doing laboratory-centered/concept oriented activities which were drawn from available science curriculum materials modified to fit the learning cycle model and chosen to develop concepts developmentally appropriate to elementary students. Activity Type 3 was devoted to discussion of practical issues of implementation of the material learned in the workshop by the participants (i.e. identification of other concepts compatiable with their student's learning patterns, designing their own activities using the learning cycle, obtaining needed equipment, equipment storage and management, and managing a classroom discussion).

The follow-up Saturday meetings were used to carry on additional activities and to also share and discuss problems of implementation.

The staff for the project included content specialists in Chemistry, Physics, and Biology, a specialist in developmental learning, and an elementary science teacher.

The project was evaluated formally with a classroom practices survey which was administered before and after the project and with an opinion questionnaire administered at the conclusion of the project. The following results were noted:

- Project participants increased the amount of time they spent teaching science. (The participants reported an average of 125 minutes per week teaching on the pre-project survey and 200 minutes per week on the post-project survey.)

- Project participants decreased the amount of science time spent on reading activities and increased the amount of time spent on lab activities. (Science time spent in reading: 24% before, 13% after the project; science time spent in lab activities: 34% before, 52% after the project.)

- Virtually all the participants were using the learning cycle approach to some extent after the project summer experience.

- Project participants enjoyed the freedom and time to explore existing curriculum materials, enjoyed time to share with colleagues, found the learning cycle a usable teaching tool, and appreciated an informal and relaxed classroom atmosphere.

- Having an active elementary science teacher on the staff was extremely important to the success of this project.

Funding Year: 1980
Grant Amount: $31,348
Discipline: Interdisciplinary

## Mathematics Project for Teachers of Native Americans

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This project was an outgrowth of a series of conferences held on selected Indian reservations to identify needs in science and mathematics education. One clearly identified need was greater involvement of Native Americans in the study of mathematics. Inadequate preparation in mathematics, coupled with widespread math anxiety and avoidance, has been a major barrier to reservation students pursuing scientific and technical training. This project assisted teachers from Indian communities to increase the appropriateness and attractiveness of their mathematics offerings for Native American students.

Project activities included two Mathematics Seminars for Teachers of Native Americans and six in-service courses. One of the Seminars was held October 8-10, 1981 at Portland, Oregon, in conjunction with the 20th Annual Northwest Mathematics Conference; the other March 24-27, 1982 at Pocatello, Idaho, in conjunction with a regional meeting of the National Conference of Teachers of Mathematics. These Seminars served to acquaint teachers with teaching strategies and materials that might serve as alternatives to those in current use. In addition to participating in Seminar sessions devoted exclusively to issues concerning the mathematics education of Native Americans, participants attended workshops and other sessions selected from the mathematics conferences' programs to meet individual needs and interests. Twenty-five elementary teachers selected from Indian communities in the Pacific Northwest participated in the Seminars. Also, 25 junior and senior high school teachers participated in a concurrent activity as part of a companion program for secondary teachers funded by the National Science Foundation.

As part of a previous project, also funded by the National Science Foundation, the first Mathematics Seminar for Teachers of Native Americans had been held in conjunction with the 19th Annual Northwest Mathematics Conference, October 8-11, 1980 in Spokane, Washington. As a result of that Seminar, local in-service courses were arranged in areas where teachers wished additional information and instruction about materials and methods viewed at the Seminar. Six of these in-service courses were conducted as part of this project. They were:

1. "Mathematics for Primary Levels," August 4-14, 1981 at Browning, Montana, on the Blackfeet Reservation, 5 quarter hours credit through Lewis and Clark College;

2. "Using Mathematics Their Way," August 17-25 at Omak, Washington, adjoining the Colville Reservation, 3 quarter hours credit through Seattle Pacific College;

3. "Mathematics in the Middle Grades," August 17-25, 1981 at Omak, Washington, 3 quarter hours credit through Seattle Pacific University;

4. "Mathematics in the Intermediate Grades," August 17-24, 1981 at Plummer, Idaho, on the Coeur d'Alene Reservation, 2 semester hours credit through the University of Idaho;

5. "Mathematics in the Intermediate Grades," August 17-24, 1981 at Plummer, Idaho, on the Coeur d'Alene Reservation, 2 semester hours credit through the University of Idaho;

6. "Mathematics in the Middle Grades," six Saturdays during the 1981-1982 school year, at Wapato, Washington, on the Yakima Reservation, 3 quarter hours credit through Seattle Pacific University.

The total enrollment of grade K-6 in these courses was 102, ranging from 15 at Lapwai, Idaho, to 22 at Browning, Montana.

Funding Year: 1981
Grant Amount: $46,040
Discipline: Mathematics

# Infusing Microcomputers, Calculators, and Manipulatives into Elementary Mathematics

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This project implemented a three-week intensive workshop for 40 elementary mathematics teachers, July 6-July 24, 1981. The project is directed toward the improvement of elementary mathematics for grades K-6 by integrating teaching with computers, calculators and manipulatives consistent with accepted principles of learning.

The workshop utilizes activity-oriented sessions, laboratory and exploration sessions, and presentation/discussion sessions. The project is divided into three phases. The first phase explores new materials and activities directed toward purposeful play as a means of entering the child's world of learning mathematics. This phase stresses the need for a variety of manipulatives and activities, need for careful selection and sequencing of the activities and the need for special attention devoted to integration of computer and calculator activities among the manipulatives.

The second phase, Infusion, is directed toward infusing computer and calculator activities. Participants are instructed in operation of microcomputers, evaluating and modifying elementary mathematics software. Learning theory and problem solving are integrated with computer and calculator activities. The third phase, Evaluation, provides participants time to share results of implementation of workshop ideas.

The workshop utilizes specialists in a variety of areas of elementary mathematics education, a specialist in instructional application of computers in mathematics, and a specialist in programming software for mathematics classes.

Although the evaluation phase is still in progress, preliminary data indicate that participants are seriously attempting to implement the ideas, methods and materials from the workshop. The first academic year follow-up was almost entirely devoted to implementation problems and techniques.

Funding Year: 1981
Grant Amount: $37,071
Discipline: Mathematics

# Environmental Science for Elementary Teachers

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Four primary objectives were set for this project:

1. To strengthen the background of elementary teachers in environmental science.

2. To increase the elementary student's awareness of the creative, dynamic nature of the environment.

3. To integrate environmental education into the total school curriculum.

4. To construct teaching aids for environmental programs emphasizing the use of inexpensive materials.

The project, which carried three hours of graduate credit, consisted of a three-week Summer Institute from June 23-July 11, 1980, with evaluation and follow-up activities during the 1980-81 school year. The Summer Institute consisted of two parts. The morning of each day was taken up in presenting concepts in environmental science. The afternoon sessions were devoted to using Outdoor Biology Instructional Strategies (OBIS) that enhanced the morning session. OBIS, developed through a previous National Science Foundation supported project, provides learning activities for elementary students in the out-of-doors by offering investigations emphasizing the use of natural and man-managed environments. These activities may be used independently or may be sequenced to create a program to suit the curriculum. The activities introduce basic concepts of ecology in ways that are both fun and challenging for elementary students. Underlying all OBIS materials is the assumption that a basic understanding of ecosystems, populations, communities, food chains, and interactions of organisms with the environment is essential in making intelligent decisions about the environment.

The Summer Institute took place at the McKeever Environmental Learning Center, a new, well-equipped center supported by the Commonwealth of Pennsylvania. The Center has overnight lodging facilities, dining hall, auditorium, Discovery Building containing classrooms, library, and exhibits, in addition to the outdoor facilities based around a 205-acre tract of woods, fields, and ponds, permeated by four miles of trails. Many hands on activities were available to the participants at this facility.

In the academic year following the Institute several follow-up and evaluation activities took place. These follow-up visits to the teachers and schools showed most participants using OBIS in their curriculum with confidence and enthusiasm. Meetings with the participant's supervisor showed that all knew and agreed with the curricular changes. Some principals were encouraging other teachers to follow the participant's examples. In addition, pre-testing, post-testing, testing of

competencies, and participant evaluations revealed strong improvements in all the project participants. The average increase in scores from pre- to post-test was 26%. Of the 78 competencies, the average met at the beginning of the project was 15%; at the end of the project this figure had increased to 67%. Overall, the response, participation and enthusiasm of the teachers greatly exceeded the original project expectations.

Funding Year: 1980
Grant Amount: $18,011
Discipline: Biology

# Problem Solving with Geology

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Forty-two intermediate teachers (grades 4-6) from Western Pennsylvania and Eastern Ohio participated in an intensive two week inservice science workshop held from June 22-July 3, 1981. The program was entitled "Problem Solving with Geology."

Local geological anomalies at Lake Arthur and McConnel's Mill State Park, Pennsylvania, were the curriculum focus for the workshop. The major anomaly involved the formation of a gorge at right angle to the drainage basin. To provide the teachers with a background needed to formulate a hypothesis regarding the formation of the gorge, miniproblems involving erosion, sedimentation, river patterns, drainage basins, topographical maps, fractures and minerals were presented in hands-on activities, short problem solving lecture sections and inquiry oriented slide shows. A problem solving methodology was used throughout the workshop.

Prior to the workshop, the five member staff of the project participated in a two day preplanning session. The staff visited each field site, developed self-paced inquiry guide sheets for specific geological discrepancies viewed at each site and prepared a detailed agenda of the two week program. The inquiry process emphasized during the workshop has been carried over into other courses offered by the staff.

During the workshop the elementary teachers interviewed elementary aged children to assess their intuitive understanding of geological concepts. Teachers worked in teams on the development of the interview and in monitoring responses. All interviews focused on a specific concrete geological concept.

During the second week of the workshops, the elementary teachers shared in the Open University Forum geology projects suitable for use with elementary children. All projects were displayed in a hands-on fair type approach. The event was covered by the area's news agencies.

Each participant received a 300 page handbook on geology concepts and projects for elementary students, a set of 36 inquiry oriented slides on geology concepts, classroom sets of minerals and fossils sets of punched cards for the classification of minerals and a stream table.

Upon returning to the classroom, each teacher conducted an inquiry oriented geology project with his/her students. Each participant received three hours graduate credit upon completion of the classroom project. Staff members visited several classrooms and school sites at the request of a participant. The purpose of the visit was to assist the participant in establishing geology trails or to discuss the geology of the school site. A summary of the classroom projects was sent to each participant via a newsletter.

The staff was delighted with the 100 percent attendance rate at all sessions and the enthusiasm and dedication of the participants. The project director will present a workshop on the project at the National Science Teachers' national convention in April at Chicago, Illinois.

Funding Year: 1981
Grant Amount: $24,632
Discipline: Geology

# Computers in the Elementary Classroom

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This project is designed to fill a "need to know" about computers, their current applications and future uses in the elementary classroom. Besides teaching the fundamentals of programming with hands-on experience for the elementary school teachers involved, we are concerned with preparing them for both the long and short range future possibilities involving computers. We also believe that it is important for them to be aware of the limitations of computing, and point this out in the sessions.

The program is composed of 12 mini-course units with a round table discussion session at the end of each unit. Two units are taught in parallel by the instructors involved in the program. At the end of each 3 to 4 week minicourse, the round table discussion period provides the instructors with the opportunity to obtain feedback from the students with subsequent adjustments in the presentations to meet the students' expressed needs.

The fall session consisted of the following six mini-courses:

1. General Problem Solving Concepts
2. Computers in Society
3. How Computers Work
4. What is Programming
5. LOGO
6. LOGO Workshop

The purpose in the fall was to give the participants an indepth appreciation of computing through direct programming experience. We have been fortunate enough to have received a copy of MIT-LOGO which we believe will have a major impact on the way people learn to program.

The Spring Semester will cover a variety of topics ranging from learning BASIC to purchasing hardware and software. The spring mini-courses will be:

1. Hardware Concepts
2. Introduction to BASIC

3. Purchasing Hardware

4. Purchasing Software

5. CAI/CMI Concepts

6. KAREL the Robot

Funding Year: 1981
Grant Amount: $33,830*
Discipline: Computer Science

* Funded jointly by the National Science Foundation and the Department of Education.

## Energy and Pollution Study for Elementary Teachers

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Forty teachers of fifth and sixth grades are studying with an interdisciplinary team of Wilkes College scientists and educators; course content focuses on the two critical areas of energy and pollution. An objective of the project is to develop support systems for participants and provide consultant assistance in integrating these content areas into upper elementary science classrooms. Linkages are being developed among participants and community agencies in order that teachers can make use of community resources in teaching energy and pollution content areas in their classrooms. For example, the week-long summer 1981 program focused on the "Community as a Resource", and field trips were taken to a mining village, a nuclear power plant, a solar energy project, a photo-voltaic cell aray, a strip mine, and an anthracite coal museum. A curriculum plan and take-home materials to be used in the classroom (film strips, ditto masters, etc.) were provided in the workshop.

The fall semester operated under the assumption that before classroom teachers could teach about energy, they first must understand some basic principles about energy. Therefore, several classes were devoted to those mechanical principles which relate to the concepts of work, power, and efficiency. The cost of energy conversions was discussed as were the laws of thermodynamics and the concept of thermal efficiency.

The above background was then applied to energy and pollution. Among the topics discussed were oil, gasoline, natural gas, and city gas, and the chemical composition and structure of each. Coals were discussed to complete a basic discussion of fossil fuels along with the problems involved with mining, including mine water.

Topics to be covered in the biological section will tie together the natural biological system and how pollution and energy are influencing these systems.

An innovative aspect of the project is the plan for creating a "multiplier effect"; college scientists and a continuing education specialist will assist teams of participants to select, research, design and plan for energy/pollution modules suitable for inservice presentation. These modules will be presented under the sponsorship of the area school system and the College. In this way, other fifth and sixth grade teachers in the region will have the opportunity for inservice education in energy/pollution after the grant support ceases.

Project evaluation data will be gathered and analyzed from a pre- and post-test completed by participating teachers in the subject matter of energy and pollution, a questionnaire to determine attitudes of teachers toward teaching science, and a questionnaire administered at the conclusion of the fall 1981 and spring 1982 semesters to evaluate curriculum design and instruction. Modules developed for inservice education will be evaluated by peer review critiques.

Funding Year: 1981
Grant Amount: $43,843
Discipline: Interdisciplinary

## Social Studies Summer Program for Elementary School Teachers

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The objective of the program was to provide 1st-3rd and 4th-6th grades teachers theoretical knowledge and laboratory experience in Social Sciences courses, with emphasis on: Geography, Sociology, Economics and U.S. and P.R. Government. The project intended to offer seminars and laboratory experience in those fields to 50 full time and 50 part-time participants. First to third grade teachers were to be assigned to the June program while 4th-6th grade teachers would attend the specially designed July program. The seminars were programmed to start at 8:00 A.M. and to finish at 3:30 P.M. during the June session. The July program was designed for two groups of teachers. One group was assigned to the 8:00 A.M.-3:30 P.M. program and the second to the 10:00 A.M.-5:00 P.M. schedule. Participants were to receive books, meals and transportation subsidies, and laboratory materials.

The project was to be developed in conjunction with the Island's Department of Education, Social Studies program officials.

Sixty-three teachers applied for admission to the project, seventeen of which registered and started the June program. Twelve partcipants completed the June program. Thirty-four of the applicants registered for the July program. Due to the large number of 4th-6th grade teachers who registered, two groups were created for this session. Twenty-four of those teachers completed the July program.

Those participants who had the opportunity of going through the complete program evaluated the project as excellent and requested follow-up seminars and an additional summer program geared towards specific areas of the Social Studies.

It is the impression of the Project Director that the major difficulty of the program was related to the recruitment process. Most of this procedure was channeled through the Department of Education. This method proved to be slow and deficient, for our needs. The Social Studies program's directors have made recommendations with the intention of reducing this situation in future occasions.

Funding Year: 1981
Grant Amount: $39,946
Discipline: Social Science

# Energy Education Program for Elementary School Teachers

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In this period of increasing public energy awareness, many elementary teachers feel a need for instruction in oft-ignored subject areas dealing with Energy Concepts, Conversion Systems, and Conservation. The Energy Education Program at URI provides these teachers not only with the necessary instruction in this area, but also gives them some experience in using existing and/or developing new objective oriented, energy-related activity modules.

The project's design is that of a 15-day segmented program consisting of: a) a three-day summer segment immediately following the 1980-81 academic year, b) a one Saturday a month academic segment beginning in September and ending in May, and c) a three-day follow-up segment occurring at the end of the 1981-82 school year. During this program the participants are given a careful blend of understandable, quantitative science along with carefully integrated directly transferrable pedagogical methods/materials. They are also given an opportunity to construct apparatus/activity packages for use at their own schools and make field studies at commercial and residential power producing facilities.

Since most elementary science teachers have not had as much scientific background and/or mathematical preparation during their pre-service training as their high school counterparts, the background reinforcement portion of this program deals primarily with energy concepts, conversion systems, and conservation at an introductory or intermediate level. (Teachers interested in going beyond that point can opt for further in-depth studies at a later time.) The scientific background presented provides the basic understanding of these various topics. Specifically, major attention is given to the following energy conversion systems: fossil fuel, nuclear (both fission and fusion), solar radiation, hydroelectric, ocean thermal, tidal, ocean waves and currents, biomass, geothermal and wind energy systems. In addition to developing the basic scientific principles involved in each of these systems, the lectures also contain material on a) the estimated raw energy available in each of the above conversion processes together with the expected life times of our non-renewable resources, b) the theoretical and technological limitations of these various conversion systems, c) the effect on the environment of our technological efforts, and d) interdisciplinary energy perspectives. The interdisciplinary aspects are inserted whenever possible since integration of a social/political/environmental/economic/historical issue into the energy curriculum helps children to apply what they are learning. Each of the conversion system discussions contains associated demonstrations and activities that are designed to be used by classroom teachers at the appropriate grade level. These activities are selected and planned in collaboration with experienced, in-service elementary science teachers, four of whom are available on the staff to organize and assist with the subsequent instruction during these activity periods. In previous programs we found that some of the participants were desirous of additional activity familiarization or technical information in particular topical areas. Accordingly, we are providing in this program for the time and staff needed in order to offer optional parallel program segments.

If participants opt to receive credit for this program, one of the criteria is that they must infuse several of the activity packages (which they developed) into their curriculum. They must also provide student and self evaluations of these lessons. In addition, staff visits are made on request to participants' schools to assist with the implementation of this material. Participants are also expected to be in contact with the staff during the academic year segment in order to receive guidance and approval of the lessons and activities which they plan to implement in their classrooms.

At the conclusion of the program participants will receive an Energy Packet. This Packet contains an extensive annotated bibliography for future reference, and teaching materials which they have individually designed and/or selected and learned to use during the program. Some of these materials take the form of new directions for games, puzzles, art projects, toys, scripts for puppet or children's dialogue for shows and plays, materials for the construction of models and other useful apparatus, film strips, transparencies, field trip possibilities, simulations and selected spirit masters. Participants will also receive and be invited to contribute to the University's Energy Education Bulletin, which is designed for the sharing of information on new curriculum developments and materials among previous program participants.

Evaluation of the program will be made through three sources: 1) daily activity-oriented lesson plans based on the previous day's proceedings, which are evaluated by the entire program staff; 2) a summary written evaluation of the program completed by all participants on the last day of the program; and 3) a follow-up questionnaire sent to each participant in order to identify program strengths and weaknesses.

Funding Year: 1981
Grant Amount: $44,695
Disciplines: Interdisciplinary

# Outdoor Biological Science Workshop for Elementary Teachers

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The Outdoor Biological Science Workshop for Elementary Teachrs was conducted May 31 through June 5, 1981 on the Hardy Campus of Black Hills State College. A follow-up day was held November 14, 1981 at Spearfish, South Dakota. Sixteen participants were enrolled in the workshop. The group included 15 elementary teachers from South Dakota and Wyoming (all with a minimum of two years teaching experience) and one elementary school principal. Most of the teachers were from school districts located on or near Indian Reservations.

There were three objectives of the workshop. Objective #1 was to increase elementary teachers' background of biology--particularly in the area of ecological concepts. Objective #2 was to acquaint elementary teachers with various science processes and concepts that can be introduced through outdoor activities with students. Objective #3 was to provide elementary teachers with numerous hands-on activities that can be done with minimal equipment and cost. The thrust of the workshop, then, was to carry out a variety of outdoor hands-on activities, with little or no equipment, that could be repeated by the teachers when they returned to their home schools in the fall. The follow-up day in November was to allow the participants to share their activities, successes and failures with the rest of the group. It also served as a stimulus for teachers to, in fact, teach biology outdoors to their students. Many of the activities carried out at the Hardy Campus in the Black Hills were borrowed from OBIS, SCIS, ESS and other curriculum projects. Still others had been developed over several years by the workshop director. The activities centered about key ecological concepts such as food chains, food webs, habitat, niche, predator-prey relationships, communities and ecosystems. Other concepts such as simple plant and animal taxonomy, the role of geology on living organisms and stream pollution were also studied.

To determine if objective #1 was met, pre and post tests were administered to the group. A 25-item multiple choice instrument was developed by the project director. The results of the two tests were analyzed and it was found that all participants scored higher on the post exam. To determine if the difference was significant, a t-test was applied to the data. A null hypothesis of no significant difference between the two means of the two tests was rejected at the 1% confidence level on a one tailed test. The t-value was 5.98. The director feels that these results indicate that the participants did in fact increase their knowledge of biology in the area of ecological concepts.

To determine if objective #2 was met, a pre-workshop questionnaire concerning the participants' backgrounds and attitudes toward outdoor science activities was administered anonymously six months later at the follow-up session. Statistically significant increases to five of the six items on the questionnaire were found. These include gains in present knowledge of science content, how to conduct hands-on activities and field trips, how often the participants teach science, how much the participants like teaching science and how many times a year the teachers take their students outdoors to teach science.

Objective #3 was met, in part, by the workshop director providing a wide variety of hands-on experiences for the participants. It was also met by assigning the participants two hands-on activities (of their choosing) to teach to their students, and the objective was also met, in part, by each of the participants sharing their two activities with the rest of the group (32 activities in all).

The project director felt that the best indices of objectives being met were the spontaneous comments from the participants. Such comments included, "Gee, I didn't know science could be so much fun", "Why haven't I been teaching science like this before?" and "Will there be another workshop next year?"

Funding Year: 1981
Grant Amount: $6,188
Discipline: Biology

## Inservice Workshop in Science for Teachers on South Dakota Indian Reservations

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This project's primary objective was to develop and maintain increased science competency in the elementary and junior high schools on the Indian reservations of South Dakota. In order to better achieve this and other objectives, a short planning conference was held during April, 1980, to identify crucial areas of concern and key administrators, teachers, and community representatives for whom the program should be targetted.

This was followed by a four-week summer workshop to which these key individuals, 30 teachers and potential leaders of the South Dakota Indian reservations, were invited. The program was held on the campus of the University of South Dakota and consisted of workshops in the areas of chemistry, biology, earth science and science education. The intent of this summer component was to adapt, modify, and/or develop science materials applicable to bilingual bicultural education on the Indian reservations. A second purpose was to interact directly with science faculty of the University of South Dakota and Sinte Gleska Community College (Rosebud Reservation) and Oglala Sioux Community College (Pine Ridge Reservation), in order to achieve a higher level of basic science knowledge and to increase levels of communication between teachers, community college faculty, and university faculty.

During the 1980-81 academic year, two workshops were given during the South Dakota Indian Education Association Meeting in Rapid City, South Dakota. Some of these participants and other staff members from the University of South Dakota held workshops and informal discussions with reservation teachers. The purpose of these sessions was to achieve a multiplier effect and to present the science content and materials to teachers and administrators unable to attend the summer component in Vermillion.

Funding Year: 1980
Grant Amount: $44,344
Disciplines: Interdisciplinary

Economic Concepts and Applications for Elementary Teachers

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This grant supported two multi-state, inservice training projects dealing with the basic economics of the market place, conducted in the state of South Dakota during the summer of 1981.

The project consists of two phases. The first phase focused on two separate four-week summer institutes. One institute was held on the campus of South Dakota School of Mines & Technology in Rapid City from June 8 to July 1, 1981, and the other at the University of South Dakota in Vermillion from July 6 to July 30, 1981.

During the academic year, the Center for Economic Education will conduct a follow-up one-day workshop on the campus of the University of South Dakota for the participants from school systems in the Eastern region, and a follow-up workshop at the South Dakota School of Mines for those participants in the Western region during May, 1982. The summer institutes had 70 participants: Eastern Regional Institute: 37 elementary teachers, (K-6) from Eastern South Dakota, N.W. Iowa, S.W. Minnesota, and N.E. Nebraska. Western Regional Institute: 33 elementary teachers (K-6) from Western South Dakota, N.W. Nebraska and Eastern Wyoming.

The program is being planned and implemented by the Department of Economics, and the Henry T. Quinn Center for Economic Education at the University of South Dakota at Vermillion, and the State Department of Secondary and Elementary Education, Pierre. A total of five semester graduate credit hours was earned by each participant.

The purpose of these institutes is to: (1) provide a basic background in economics for elementary teachers (K-6) who possess no formal training in the subject or for teachers whose training has become dated, and (2) introduce these teachers to the methods, literature, curriculum, and developments in economic education, which will aid them directly in the translation and transfer of basic economic concepts into their specific subject matter areas/grade levels.

Funding Year: 1981
Grant Amount: $48,973
Discipline: Economics

## Concept Development in Ecology for Elementary Teachers

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This project is designed primarily to strengthen content background of the 25 elementary school teacher participants in the area of Ecology. This is an academic year experience; the participants are meeting on Thursday evenings during the school year, 1981-82, and several Saturday ecology field investigations are planned. The selection of the Ecology concepts and processes has been made after a diagnostic pre-session involving all of the participants. These include: consumers, decomposers, producers, climate, organics and inorganics.

The emphasis of the class presentations has been placed upon direct, concrete activities to exemplify and model the Ecology concepts under consideration. These activities have occurred primary through laboratory investigations as well as numerous field studies. In addition, a strong emphasis has been placed upon the teaching of appropriate Ecology methods for elementary school students.

Thus far, project staff has visited with each participant and plans more during the spring semester. The purpose of these visits is two-fold: one is to assist in translating Ecology concepts to particular elementary school classrooms, and the other is to assist in the development of an in-service training program the participants will conduct with their respective school and faculties.

This project has been conducted as a team-taught experience including a university Ecology specialist, and a science educator, with the assistance of public school science supervisors. Participation has been enthusiastic and final outcomes will be measured in May 1982, with three post-test measures including Ecology attitudes, teaching methods and concept understanding. An important product of this project will be an elementary school Ecology unit which will be developed and disseminated by each participant. They will be housed in the respective elementary school library of each of the participants and available for wider use.

Funding Year: 1981
Grant Amount: $27,002
Discipline: Biology

## Project in Mathematics for Teachers in the Four-County Area of The Lower Rio Grande Valley

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Twenty-four upper elementary teachers (Grades 3-6) were selected by the project staff and a representative of the area public schools. Priority was given to those applicants who demonstrated academic needs, had potential to benefit from the program, and represented all rural and urban areas in the Lower Rio Grande Valley of Texas.

The project included a three-week summer course which provided instruction in estimation, measurement, and geometry with special emphasis on the metric system. In addition, it dealt with diagnostic procedures and with alternative instructional modes. The course format was a "hands-on" approach which provided experiences in the use of such instructional aids as metric measuring devices, miras, geoboards, cuisenaire rods, place value blocks, and calculators. The instructional component of the project was complemented by potpourri sessions featuring guest lecturers, make-and-take sessions, problem solving sessions, and audio-visual presentations. The course was team taught by Dr. M. Geralda Schaefer and Ms. Olga Ramirez and carried three semester hours credit.

On the open-ended evaluations all participants indicated that the choice of subject matter was appropriate. Throughout the course it was evident that the content was of great interest to the participants and that they felt that the instruction was providing much needed academic development. In indicating the most beneficial aspects of the program, the respondents unanimously noted the activity approach used throughout with special mention (18) of the activities in geometry and the metric system. Other aspects considered beneficial by a vast majority were the class atmosphere and the sharing among the teachers. It was evident that the attitude of the participants was exceptionally positive; they showed an eagerness to learn and an enthusiasm for participation.

During the academic year 1980-81 the project staff visited the participants in their schools to assess the impact of the project in the local situation, to provide additional instruction and suggestions for teaching, and to reinforce the relationship between the area schools and the mathematics faculty of Pan American University.

Funding Year: 1980
Grant Amount: $11,539
Discipline: Mathematics

# Project IMPET: Improvement of the Mathematics Preparation of Elementary Teachers

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Project for the Improvement of the Mathematics Preparation of Elementary Teachers (Project IMPET), was conceived as a result of the need both felt and expressed by South Texas elementary school teachers for greater skills and a healthier attitude in the area of mathematics teaching.

Specific objectives established for Project IMPET were the following:

1. An increased understanding of mathematics concepts and the development of skills at the elementary school level so as to more effectively communicate mathematics to the early adolescent.

2. An increased awareness of and instruction in manipulatives, materials, methodology, and subject matter new to the elementary school.

3. An incentive program attractive to women and minority groups not now sufficiently represented in sciences, especially mathematics.

4. An opportunity to develop a more favorable attitude toward mathematics, especially among minority women.

5. The ability to create curriculum resource banks so as to enable the establishment of multi-faceted, non-traditional approaches to learning.

Participants sought for Project IMPET were those with grade level three, four, or five teaching assignments, at least two years of teaching experience prior to participation in the project, and, generally, a background of six hours or less of college mathematics.

In reviewing the application forms of the twenty-three participants selected, eleven were observed to have no semester hours credit in college mathematics, six with three semester hours credit, and two with nine semester hours credit. The group was comprised of twenty females and three males. Ten participants were Mexican Americans.

An innovative feature of Project IMPET was the weekend workshop format. Six weekend workshops were conducted during the 1980-81 academic year, three during the Fall Semester and three during the Spring Semester. Each weekend workshop met for a total of fifteen hours: 6-10 Friday night, 8:30-12 and 1-5 Saturday, and 8:30-12 Sunday morning. This format allowed for a minimum of interference with professional duties while providing sufficient time for mastery of subject matter. Other significant features included the emphasis placed on new trends in elementary school mathematics (i.e., the calculator, the metric system, the minicomputer, and motion geometry), and the attention given to the development of alternative curriculum materials.

In order to assess the degree to which the project objectives were attained, a project evaluation form, an achievement test, and an attitude scale were devised. The IMPET Evaluation was a posttest only instrument and not used to measure growth. The IMPET Achievement Test was a five-alternate multiple choice test containing twenty-four (24) items developed to measure growth over the program period. The Revised Math Attitude Scale was a 20-item Likert-type attitude scale developed to measure changes in attitude.

The achievement test and attitude scale were administered on a pretest-posttest basis. The means of the tests were calculated and then compared through the use of the t-test of mean differences. The pre-post analysis revealed a statistically significant change at the 0.01 level for both the achievement test and attitude test.

Fourteen participants (61%) successfully completed the project and received 6 semester hours credit in mathematics. Five participants (22%) successfully completed the Fall Semester workshops and received 3 semester hours credit in mathematics.

Funding Year: 1980
Grant Amount: $18,729
Discipline: Mathematics

# The Teaching of Elementary School Earth Science

Dr. Kathleen Martin
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This project was conducted under two years of program funding. The target audience was thirty teachers each year; in the 1980-81 academic year these were teachers of grades 1-5, while in the 1981 project they were teachers for grades K-4. The objectives were the same each year:

1) to increase the elementary teacher's understanding of concepts in earth science, particularly the areas of astronomy, geology, oceanography, and meterology;

2) to model a methodology appropriate for teaching elementary school earth science, one that emphasizes experimentation;

3) to develop the teacher's competence in working with curriculum materials and scientific equipment that can be used in elementary earth science; and

4) to help teachers recognize how the learning of science is related to the child's intellectual development.

In the 1980 project, the group met for a three-hour time block every Thursday evening throughout the academic year. The 1981 project centered around a 5-week summer session, during which participants met for three hours daily. Half of each class focused on understanding various concepts in earth science through lecture, discussion, and demonstration. The other half of classes consisted of laboratory work related to those same concepts. Field trips in the 81 project included a weather balloon launching, night sky observation, and geological museum visit.

In the 1980-81 academic year project, the participants were particularly enthusiastic about the laboratory dimension of the course. The lab provided hands-on experience with several hundred experiments in meteorology, geology, astronomy, and oceanography. The structure for this aspect of the course was modeled after the elementary school learning center. A number of experiments were set up every class period, and teachers were free to move at their own pace among the various options. The instructors offered assistance in understanding the concepts involved and also helped teachers determine how to modify and/or extend the experiments to accommodate their specific classroom needs.

The laboratory experience was designed as a prelude to actual classroom implementation. Teachers were required to use a minimum of sixteen experiments with their own students. As it turned out, the teachers used many more than the required number of experiments. In fact, approximately one-third of the teachers used the earth science that they learned in the course as the basis for their science curriculum for the entire year.

Following each classroom implementation the teachers reported the results of the work with their students on cassette tape. This proved to be extremely effective.

In addition to listening to the taped reports, the instructors visited each teacher's classroom twice during the academic year. These visits were invaluable in helping modify the course to best serve the teachers, allowing the instructors to see the experiments in the hands of students and, consequently, to ascertain the strengths and weaknesses of the approach being used in the course. As a whole the teachers welcomed the visits as an opportunity to seek suggestions that would improve their teaching.

Following the 1981 summer project, participant evaluations were also conducted. These showed that the summer's work had changed participants' attitudes toward science and science teaching, with their remarks indicating that:

1) science would have much greater emphasis in teaching;

2) fears of science were reduced;

3) excitement about science teaching was renewed;

4) science teaching would shift from fact to observation and experimentation;

5) confidence in science teaching was established; and

6) the awareness that science was all around was established.

A second evaluation was conducted at the end of the Fall 1981 term. Teachers were asked the extent to which they used the summer work in earth science in teaching their classes and how they would now evaluate the project after the test of time and the classroom. Responses showed that the teachers were utilizing the work learned in all four areas of earth science. When asked to compare the summer work with other graduate experiences, the majority of teachers responded that the project was one of their best graduate experiences, and they thought similar opportunities should continue to be offered. Classroom visits and telephone conversations confirmed the written responses to the second evaluation.

| | | |
|---|---|---|
| Funding Year: | 1980 | 1981 |
| Grant Amount: | $23,480 | $13,129 |
| Discipline: | Earth Sciences | |

Improving General Science

Content Knowledge of Teachers K-3

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Fifty participants were selected from more than 100 applicants to participate in the General Science Content Program. Twenty-five individuals participated in the fall semester, 1981; twenty-five participants are presently enrolled for the spring, 1982 program. Participants were selected using the criteria as stated in the proposal (see brochure). The Program was well publicized throughout central Texas with news items in newspapers and in science teacher journals. In addition a brochure was designed and mailed to teachers, administrators, science coordinators, resource teachers and team leaders.

The Program staff believes that the following objectives have been fulfilled:

1) To improve the science content knowledge of participants from central Texas and to increase their awareness of accompanying appropriate teaching strategies.

2) To develop and maintain communication and cooperation between scientists at The University of Texas at Austin and the participants.

3) To aid the participants in the identification and use of resources, appropriate to their level of instruction, which will aid in the teaching of scientific concepts.

Sixteen three-hour sessions were requested of the participants in addition to two Saturday field trips. All sessions, assignments, field trips, and various tasks were enthusiastically received by the participants. Many of the participants also attended the state-wide Conference for the Advancement of Science Teaching at The University of Texas - Arlington in November, 1981, and the Austin Association for the Education of Young Children - Annual Conference in Austin, Texas, in October. The participants also attended the Smithsonian Film Programs at the University. The content of the film series enhanced the presentation of the course materials throughout the Program.

The following content presentations included: environmental science, inner workings of bugs, rocks and minerals, microcomputers in elementary school, basic astronomy and simple machines. Laboratory sessions were conducted after each lecture session. These lessons were duplicated, thereby providing each participant with approximately 125 different, creative science lessons for the elementary classroom.

The special session, "Primary Grade School Kids Meet the Scientists," was especially well received. Five scientists intereacted with children in grades K-3 throughout the semester. Videotapes and slides were taken during the presentations. The Program staff is currently preparing a 20-minute videotape of these special sessions. The videotape will be used in the preservice and inservice training of teachers. In addition the videotape hopefully will motivate teachers into wanting to teach

more science to children. The tape will also help to facilitate the communication between scientists and science educators and elementary school teachers. The Austin Independent School District is interested in showing the videotape on their cable television station. The school district has also been very helpful during the technical production of the tape.

A slide presentation is also being designed by the staff and will be presented at the Conference for the Advancement of Science Teaching at Hardin-Simmons University, Abilene, Texas, in November, 1982.

The participants completed the following tasks:

a) used the science content they attained and learned how to reference science subject content, materials, and ideas for the purpose of supporting and enriching their existing science program;

b) prepared and developed supplemental classroom materials, e.g., science learning centers, science games, activities, and tasks, in the selected science areas for student use; and

c) designed and developed an inservice workshop dealing with general science content and appropriate instructional strategies.

Project evaluation has taken several forms. All participants were given the Stanford Achievement Test, Form X, as a pretest prior to their beginning the course, and Form W of the test at the end of the program. In addition, the Concerns Questionnaire developed by the University of Texas at Austin Research and Development Center for Teacher Education was also administered as a pre- and post-test, as a measure of the effectiveness of the program in attaining objective one, awareness of appropriate instructional strategies, and objective three, the use of resources in science instruction. Logs were also kept by participants, recording their science lessons, amount of time spent teaching science weekly, and number of times they called upon scientists and science educators to assist them in their instructional program. All this data is currently being analyzed.

The Program staff believes this inservice project has fulfilled the intent of the proposal. All participants have been positive toward the Program and are concerned about the lack of funding to support similar programs that will assist them in their teaching.

Funding Year: 1981
Grant Amount: $34,068
Discipline: Interdisciplinary

# Improving Intermediate Elementary and Middle School Inservice Teachers' Science Background

Dr. Lowell J. Bethel
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During the spring 1980, a survey of fifty-four (54) randomly chosen schools in the central Texas region was undertaken to determine how much science was being taught. On the basis of the data resulting from the survey, a DE-NSF grant was awarded to instruct 51 inservice teachers in environmental science, an area identified by the teachers as being important.

The objectives of the Environmental Science Education Project were as follows:

- to improve the knowledge of middle school and intermediate level school teachers from the central Texas region in environmental science;
- to aid teachers in the instruction of environmental science concept through identification and use of environmental science resources appropriate to their level of instruction; and
- to develop and maintain cooperation, communication, and (program) support between scientists at the University of Texas at Austin and middle school and intermediate level school teachers in the central Texas region.

The teachers were selected from the central Texas region within a radius of 70 miles from the university. All selected teachers taught in grades 4, 5, and 6. They were selected from both urban and rural settings with populations ranging from 5,000 to 350,000 citizens. School populations served ranged from several hundred up to 63,000 pupils. The teachers ranged in age from 23 up to 55 and from 2 to 23 years of active teaching.

The environmental science education project used a seminar-laboratory-workshop format. The primary focus aimed at providing background and experience in representative topics currently being studied in environmental science education including ecosystems, communities, energy resources, pollution, agriculture systems, environmental ethics, conservation, geology of the Southwest, and the ecology of populations. Problem solving skills, science as inquiry, and understanding the nature of the scientific enterprise are terms that were emphasized and characterized. Participants were permitted to register for up to 6 graduate hours of credit. The program which extended throughout the 1981-82 academic year was comprised of field trips, guest speakers, science seminars, and laboratory sessions designed to assist teachers in applying the environmental science content for use in their classrooms. A series of classroom visits are to be made during the project to assist teachers in the utilization of the environmental science education materials. Participants will prepare and conduct two inservice workshops in their districts.

In order to ascertain the participants' concerns, attitudes, and knowledge relative to the environmental science program, the Stages of Concern Questionnaire was

administered, together with the Environmental Education Questionnaire, and an an environmental science knowledge inventory. These were administered prior to the beginning of the program sessions, midway through the program, and again at the conclusion of the program. The experimental design was a modified pretest-posttest control group design. A comparable sample (control group) of non-participating teachers was assessed using the same instruments and procedures at the same collection points.

Administering the instruments at each of the three data points was followed by program interventions for the teachers, designed to respond to the data collected. Thus, interventions were developed on the basis of the specific quantitative data collected during the course of the environmental science program.

Several important findings came out of this study: 1) there was a significant increase in knowledge and concepts of environmental science attained by the teachers; 2) it was found that teachers' attitudes toward environmental science changed significantly over time in a positive direction, as compared to a set of control group teachers; 3) teachers' concerns during the staff development experience changed and could be identified; 4) the Stages of Concern Questionnaire was a useful instrument for identifying change in teachers; 5) in addition, Stages of Concern could be used as a formative instrument in order to assess program effectiveness when addressing the concerns of teachers about environmental science; and 6) finally, relevant interventions and program modifications could be designed and prescribed based on the diagnostic data obtained from Stages of Concern, the Environmental Education Questionnaire, and the environmental science.

Funding Year: 1981
Grant Amount: $45,602*
Discipline: Interdisciplinary

* Funded jointly by National Science Foundation and Department of Education.

# Science and Mathematics Enrichment Project for K-6 Teachers

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A total of twenty nine elementary school teachers from schools serving predominately Mexican American and Black neighborhoods of Midland and Odessa, Texas participated in up to three graduate courses--two summer demonstration school courses and one academic year course, planned and conducted so as to increase their competence and confidence in teaching physical science, life science, and mathematics activities in levels K-6.

During the summer of 1980 the participants could choose between a science or mathematics sequence of courses. In the science sequence the courses were "Science in Contemporary Society" and "Innovations in Teaching Elementary Science". The former course, taught by the chairman of the faculty of Life Science, consisted of investigations in science for an understanding of today's technological society: life support systems of air, water, mineral resources, energy, and food; populations; life styles. After completion of this course, each participant was able to state five major educational goals that he or she would like to see attained with regard to population, use of mineral resources, use and pollution of water and air, energy consumption, and lifestyles. In addition, each participant was to describe short and long-term educational activities that he or she could personally implement to help accomplish the stated goals. The methods course, conducted by the Department of Science and Mathematics Education, include such activities as: (1) self-paced modules designed to diagnose weaknesses and strengthen competence in the use of selected skills in the problem solving processes associated with teaching the recently developed elementary school science curricula; (2) practicing small group use of various materials and strategies designed to increase childrens' success with science; and (3) special emphasis on the use of physical materials that will be available from the participant's school districts, the University curriculum lab, and/or local stores to be used in (4) planning units of science instruction for use in their own classrooms for the '80-81 school year. All participants but one achieved 90% success or better in meeting these objectives.

The other option was the mathematics sequence, consisting of two courses, "Mathematical Systems for Elementary Teachers" and "New Strategies in Elementary School Mathematics". The mathematical concepts course was taught by an associate professor of Mathematics, and made it possible for the participants, by the end of the course, to: (1)describe and demonstrate concepts and skills as presented in historical sequence and context, using only those tools which were available to the various cultures that developed their respective concepts and skills to solve problems; (2) describe and demonstrate the parallelism between man's acquisition of mathematical learning and the developing child's learning; and (3) state and apply basic rules governing the use of arithmetic, algebraic, and geometric skills commonly taught in elementary schools. Activities in the mathematics methods course included: (1) work in self-paced modules designed and functions associated with recently developed mathematics curricula;

(2) practicing small group use of various materials and strategies designed to increase children's success with mathematics; (3) placing special emphasis on the use of physical materials which are available from the school district, the University's curriculum lab, and/or local stores to be used in (4) planning units for math instruction for use in participants' own classrooms during the 1980-81 school year. All the participants in the mathematics sequence of courses achieved at least 90% mastery in meeting these objectives.

In the "lab" portion of the above courses, participants functioned as intern teachers of mathematics or science lessons in the University's special summer demonstration school. In late August, a one-half day orientation session was held at the University for participants and principals of target schools, to review plans for the 1980-81 series of inservice sessions. At that session, participants were given the option of enrolling for one or two credit hours in "Special Project in Elementary School Science" or "Special Project in Elementary School Mathematics".

During the fall semester following the summer session, participants attended two all-day inservice sessions. Held in one of the most centrally located target schools, these sessions were directed and taught by project staff professors. In addition to activities designed to enrich participants' math and/or science teaching, part of each session was devoted to encouraging participants to continue sharing "What's going well?", "What's going differently than expected?", and "What needs to be changed?" with respect to science and/or mathematics lessons in their classrooms.

In the second semester, project participants attended inservice sessions two afternoons each month plus one full-day workshop. These sessions were held on the University of Texas-Permian Basin Campus. Each session in the series included activities directed and team-taught by all three project staff members. In addition, during each session some time was devoted to letting participants share problems and potential solutions they'd discovered while teaching science and/or math in their classrooms.

Cooperative support from target school districts and the University of Texas of the Permian Basin included provision of complete sets of physical materials for each participant and his or her students. The increased frequency of science lessons and increased quality of science and mathematics instruction has resulted in a measurable improvement in the performance and attitude toward science and mathematics for participants, their students, school administrators and parents.

Funding Year: 1980
Grant Amount: $39,938
Disciplines: Mathematics, Life Sciences, Physical Sciences

# The Development of Master Teachers for the Environmental Science Education of Third and Fourth Grade Children

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Division of Education
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This project is addressed to the expressed science teaching needs of third and fourth grade teachers who supervise student teachers in the member districts of The University of Texas at San Antonio Cooperative Teacher Center. Its primary purpose is to develop the content knowledge and instructional skills needed by regular and bilingual teachers to promote children's inquiry through environmental science studies. The project's secondary goal is to improve the environmental science teaching experiences of student teachers who are supervised by project participants.

Twelve third and fourth grade teachers were selected as Master Teacher (MT) candidates for project participation by The UTSA Cooperative Teacher Center. A Summer 1981 Institute, Environmental Science and the Development of Children's Inquiry Skills, was taught by science and science education faculty at The University of Texas at San Antonio. The teacher-identified areas of Ecology, Conservation of Natural Resources, and Geology were explored through lab activities that are designed to promote the development of inquiry skills as well as content knowledge. A science teaching guide was developed for the Institute by project faculty and expanded to include extending investigations designed by Institute participants. It was titled Two Communities to refer to Summer Institute focus on pond and tree communities for environmental science studies.

Two Communities is being used for workshops with teachers who were not enrolled in the Summer Institute. A special session of the annual meeting of Texas State Teachers Association in November, 1981 provided a mini-workshop experience for twenty-five teachers who received copies of the teaching guide. A local school district has requested a series of workshop sessions for elementary teachers during the Spring, 1982 term. Project faculty will conduct this series, using Two Communities as an organizing framework. Teachers who attend will be asked to serve as leaders in disseminating the environmental science teaching materials and approach presented in the guide to elementary teachers in their districts.

At quarterly intervals during the 1981-82 academic year, the MT candidates will be visited in their classrooms by the project's science education faculty for consultation on children's environmental science studies. These sessions will include student teachers who have been assigned to the MT candidates. The science education faculty will document the science teaching activities in the classrooms of the MT candidates. A one-day conference for the MT candidates and their student teachers at the close of the 1981-82 school year will examine science teaching strengths and needs.

Summer Institute evaluations by participants were very positive. All participants expressed agreement with evaluation instrument items which referred to the Institute's contribution to the development of: (1) teacher environmental science

background knowledge, (2) teacher inquiry skills, (3) ability to promote children's inquiry, (4) using environmental science investigations with children, and (5) designing science investigations for children. For items 1 though 4, 70-75% of the respondents expressed strong agreement, i.e., evaluating the Institute highly for its development of their environmental science knowledge and teaching skills. Response was more mixed, though positive, to item #5 which states, "As a result of this Institute, I have developed my abilities to design science investigations suitable for the children in the elementary school." Strong agreement was expressed by 54% of the respondents; agreement was expressed by the remainder. Classroom visitations for consultations with the teachers will clarify the significance of these assessments.

After completion of the project's academic year follow-up and special workshop sessions, additional evaluations will be made by project faculty and teacher participants. These will be examined by the UTSA Cooperative Teacher Center Policy Board to determine directions for the continuing education of teachers in science.

Funding Year: 1981
Grant Amount: $18,100
Disciplines: Biology, Ecology, Geology

## An Iquiry-Based Course in Physical Science

## for Elementary School Teachers

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Twenty-eight elementary school teachers from the Central Virginia area participated in "An Inquiry-Based Course in Physical Science" at Lynchburg College during the 1980-81 academic year. The experience was designed primarily to improve teacher attitudes toward and confidence in the teaching of science to young children. Preliminary evaluation of participants revealed great anxiety about and surprising ignorance of basic physical science.

Participants were required to decide what to investigate, to design experiments to accomplish their goals, to carry them through, and, periodically, to summarize their work in a report to the entire group. The areas of study, each nine weeks long, were light, sound, electricity, and "kitchen chemistry." The instructors in the course provided resources, ideas, questions, and substantial encouragement, but no actual direction.

Evaluation through questionnaires, post-project interviews, and post-project classroom visitations, indicates that the course did meet its major objectives. The confidence of the participants in their abilities to do physical science was increased significantly, with a parallel increase in the amount and quality of the science instruction in their classrooms. Substantial interest in a repeat of the experience exists within the local community.

Funding Year: 1980
Grant Amount: $24,412
Discipline: Physical Science

## Science for Teachers

Dr. William C. Brewington
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An interdisciplinary approach was followed in teaching science concepts, drawn from the disciplines of chemistry, earth science, life science and physics and appropriate for use in elementary school classrooms, to 23 elementary school teachers. The project was held for four weeks in the summer of 1981. The major objective was to improve the subject matter and laboratory manipulatory competencies of teachers in order to increase the effectiveness of science instruction in kindergarten through fourth grades.

The first five minutes of each session were devoted to a critique of the previous day's activities, and the results were used for program modifications. Instruction in science content was presented for two hours and was followed by a two-hour laboratory session during which teachers were engaged in classroom activities that augmented, extended or reinforced ideas and concepts taught in the "content sessions." Each participant constructed a Science Learning Center to use in teaching science in their classrooms.

From a number of possible off-campus field trips, the participants selected a trip to the Spider Museum and the Science Museum in Richmond, Virginia. The trips were quite educational and acquainted teachers with the opportunities and activities that were organized and are available for children and classes. A representative of the television program 3-2-1 Contact and several other guest lecturers were special features of the summer program.

Following the completion of the program each school system as well as the schools in which teachers taught was notified of their participation. During the fall semester (September-December 1981), the Director made visits to science classrooms of participating teachers. Such a visit was made to, primarily, offer support and observe their "newly acquired" teaching behavior in science.

Requests have been made from other participants for visits and/or staff development to be conducted during the spring.

A pre- and post-test on the content of the instructional program was administered to the teachers on the first and last day of the program, and the mean gain score on the post-assessment was 27.6. A program evaluation on the degree to which the project met its objectives, the staff, and the activities resulted in average scores ranging from 4.5 to 4.6 on a five point scale.

Funding Year: 1981
Grant Amount: $25,482
Disciplines: Chemistry, Earth Science, Environmental Science, Life Science and Physics

Achieving Regional Improvement in Elementary Science
(Project AIRES)

Dr. Robert E. Gibbs
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Through its departments of Physics and Biology, the University is offering a program in basic science for elementary school teachers in the area of Cheney, Washington during the 1981-82 academic year. In September 27 teachers distributed over grades K-6 from 5 rural school districts started the program.

The project is providing scientific background in content, approach, and educational objectives required to successfully teach investigative, laboratory-oriented science materials, including materials previously purchased by the districts and materials developed by the project staff and colleagues at the University of Washington. Participants attend two-hour biweekly sessions during the academic year, September 1981 to June 1982, for a total of sixteen meetings. These meetings operate in the "guided discovery," "hands on" mode. Participants keep a daily journal of observations, physical changes, and biological events. The physical and life sciences are carefully interrelated to present a unified view of science. Participants will teach selected units in their classrooms under supervision of the project staff. Special facilities to be used by the project include the Eastern Washington University's planetarium, greenhouse, and animal quarters, and the Turnbull Lab for Ecological Studies, the latter located at nearby Turnbull National Wildlife Refuge.

At this point the best measure of the success of this program has been the enthusiastic response of the participants. They have been very anxious to take the activities to their own classrooms, and they have delighted in sharing their experiences with us. A teacher from Great Northern School has successfully requested $500 for science materials from her school board. She worked with us in selecting excellent materials. Teachers from Medical Lake have indicated their interest in obtaining the ESS balances. They also hope to purchase some dissecting scopes for classroom use.

Several aspects of this program combine to make it effective. First, it is important that the participants receive graduate level academic credit. This insures an adequate number of applicants. Second, we operate in a relaxed and friendly atmosphere that is totally helpful and encouraging and completely non-threatening. Third, we concentrate on doing science, not on listening to science. Teachers only feel comfortable when they have worked their way through the concepts using real equipment that is available to them. As simple and as fun as this is, few of them could or would try it on their own. It is critical that these teachers have fun learning science. Only then will they have fun teaching science. They must learn that science is a way of thinking and a way of doing, not an endless list

of chapters to be read and questions to be answered. Fourth, we try to show the importance of science in an elementary curriculum and its relation to the other subjects being taught. When teachers realize that science is not just another subject area to be covered, but is in fact a perfect vehicle for using skills learned in language, math and even art, they will weave science activities into the fabric of their teaching.

Funding Year: 1981
Grant Amount: $16,281
Disciplines: Biology, Physics, Physical Science, and Astronomy

## Problem Solving and Mathematical Applications

Professor John F. Firkins
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The project consisted of an intensive three-week workshop held in the summers of 1980 and 1981--plus quarterly follow-up sessions held during the following school years. Workshop activities were designed to acquaint elementary school teachers and some elementary principals with resources and strategies which could be used to improve the problem solving skills of their respective students. During the summer workshop sessions, participants were confronted with problem solving situations in arithmetic, geometry, measurement, etc.; and shown how to develop techniques to be used in solving such problems. Daily laboratory sessions provided teacher trainees ample opportunities to apply, extend or modify those techniques. In addition, participants discussed the advantages and disadvantages of each instructional setting encountered; and were required to compile a collection of mathematical problems and instructional settings suitable for use in their own classrooms. It is anticipated that the participants will utilize such problems and settings, or others better adapted to their own personalities and preferred teaching styles, when subsequently instructing their students.

Skills and strategies acquired in the summer workshop were reinforced and extended during the quarterly follow-up sessions, with participants afforded the opportunity to share their experiences in presenting various problem solving exercises to their respective students. During follow-up sessions participants received feedback from the project staff and their fellow workshop participants.

The following examples serve as illustrations of some of the more noteworthy results of the projects to date:

- A group of 14 first and second grade teachers who participated in the 1980 project formed a group called S.I.P.S. (Support in Problem Solving). That group met monthly during the 1980-81 school year to share materials and ideas related to the implementation of problem solving at the first and second grade levels. These meetings were in addition to the regularly scheduled quarterly follow-up meetings.

- Three principals attended the 1981 workshop. The cooperation teachers have had in these three buildings is outstanding. These principals are truly curriculum leaders in their schools and districts. We recommend that some principals be included in every workshop funded for elementary teachers. It helps teachers develop a better working relationship with their own principals as well as fostering better communication between teachers and principal from the same building.

- A principal participant from the Mead School District, who attended the 1981 Workshop, has submitted a proposal to the Education Service District in this area for a mini-grant to hold a problem solving conference in his district. This is a direct result of his partici-

pation in the Department of Education funded workshop. Another participant from this same district who attended the 1980 Workshop was chosen to coordinate that district's elementary mathematics program.

- All participants joined the Washington State Mathematics Council as part of their professional commitment to quality math education in the state. The majority of the 1980 participants attended the 19th Northwest Mathematics Conference in Spokane; four of the participants of the 1981 workshop attended the 20th Northwest Mathematics Conference in Portland, Oregon, even though their own school districts would not support this as part of district inservice. The teachers felt it was a natural extension of the workshop and attended at their own expense.

- Many of the participants from both summers' workshops have submitted articles and activities to the Washington State Mathematics Council for publication in its newsletter Washington Mathematics. Fifteen articles have been published in this journal. Two articles by participant teachers have been published in the Arithmetic Teacher.

The following are the results of participants' evaluation of project related activities:

- The average participant ranked his/her own problem-solving skills on a scale of 1-10, as follows: 1980 group, 3.35 at the start, 7.30 at the conclusion of the summer workshop; 1981 group, 5.74 at start, 7.68 at the conclusion of the summer workshop.

- The average participant in the 1981 group ranked his/her ability to teach problem solving as 5.40 at the start and 8.00 at the conclusion of the summer workshop. (The 1980 participants had not been asked this question.)

In addition, by the end of each of the programs all participants had experienced the "Aha" effect to some degree, had solved many "problems," and could:

- list a set of steps for problem solving;

- contrast and compare the role of the teacher of problem solving with the role of the teacher of basic facts;

- understand that problem solving applied to all areas of the curriculum; and do a better job of ranking activities and selecting those activities that provide the greatest opportunity for problem solving.

In 1980, forty-seven teachers were admitted into and successfully completed the summer workshop portion of the project. Forty-one of these took part in the quarterly follow-up sessions. The 1981 project has 50 teachers and administrators participating.

Funding Year: 1980
Grant Amount: $27,249
Discipline: Mathematics

Funding Year: 1981
Grant Amount: $34,873
Discipline: Mathematics

# Field Biology Project for Teachers

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A basic focus of this project was to provide instruction in the content areas of biology and ecology which emphasize the field aspects of these disciplines in Southeast Washington. Instruction was provided in the content area of biological field studies with special emphasis on providing a model of instruction that was applied by elementary school teachers to gifted student projects (K-6).

The objectives of the project were to: 1) provide instruction related to the concepts of ecosystems, plant and animal community interactions, systems for naming and identifying plants and animals indigenous to the Southeast Washington area and analyzing streams, lakes and pond productivity; 2) provide experiences through field trips of methods for identifying, collecting and preserving plants and animals and methods for demonstrating aquatic and terrestrial productivity patterns; 3) prepare sets of materials for classroom use appropriate to content areas and grade levels (K-6) so that the teachers may incorporate biological field studies into their respective gifted student programs; and 4) develop a communication link between the scientific community at Washington State University and the elementary school teachers of the immediate geographic area.

The disciplines of biology and ecology with various subspecialities were presented by scientists to complement each other. This approach had proven to be most effective in Pullman, Washington during 1977-78 and in 1980 in Walla Walla under a National Science Foundation supported project. The study of the biological sciences coincided with the subject areas that were in need of expansion in the gifted science programs of the target geographic area. The selected texts, duplicated materials and non-print materials stressed the interactions of the Washington environment. Project objectives focus directly on the content needs that were identified in 1980 especially through the efforts of the Palouse Consortium Teachers Center.

As each scientist completed his or her presentation, the participants subdivided in small groups to summarize how the content could be reduced in scope and reoriented to students in grades K-6. The preparation of self-generated sets of materials for classroom use was highly rated. Finally, the integration of curriculum theory to the process helped the project achieve its goals.

A series of formative and summative indications were conducted throughout the project's duration.

Funding Year: 1981
Grant Amount: $41,166*
Discipline: Biology

* Funded jointly by the National Science Foundation and the Department of Education.

An In-Service Institute in Astronomy and Space Science

for Teachers in Grade Levels 1-6

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Oshkosh, Wisconsin 54901

The main objectives of the project are:

a) to raise the level of competency of elementary teachers in astronomy and space science; and

b) to develop a more cooperative relationship between the participants and the project staff which will continue and grow stronger long after the initial stage of the project is completed.

To achieve this objective the project staff developed a program of laboratory exercise, lectures, planetarium programs, and sky observation sessions. Thirty-six elementary teachers were selected for participants in the project. Thirty-two completed the project.

Because of the project's heavy emphasis on observational astronomy, the group met for three hours every other week from September 1980 through May 1981 to enable the participants to make observations of the night sky through seasonal changes.

A 36 item general astronomy examination was given as a pre- and post-test. Twenty-nine persons were present to take both forms. For the pre-test the mean was 11.7, the standard deviation was 3.8. For the post-test the mean was 16.9 with a standard deviation of 4.3.

Each project meeting the participants worked on a laboratory activity. Each person built a simple telescope and a sundial which they could take back to their home school. Each person also built a simple spectroscope and learned how to analyze several different light sources. Several activities were devoted to the celestial sphere and its appearance at different times of the year. They also did projects related to the phases of the moon and planets and retrograde motion.

The project had a one-day field trip to Adler Planetarium in Chicago and Yerkes Observatory in Williams Bay, Wisconsin. In addition, the project used several NASA films related to the space program and two of the Cosmos programs.

This Pre-College Teacher Development in Science project has been conducted with two groups. During the 1979-80 project under NSF sponsorship, elementary and secondary teachers participated. The 1980-81 project accepted only elementary teachers. During Spring Term 1982, a follow-up questionnaire will be mailed to both groups to determine what, if any, changes the teachers have made regarding the methods they use to teach science or amount of time they devote to science teaching.

Funding Year: 1980
Grant Amount: $20,554
Discipline: Astronomy

# Introduction to Microcomputers Applications to Elementary School Mathematics and Science

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The purpose of this project was to introduce microcomputer applications into elementary school mathematics and science classes in the northeastern area of Wisconsin (pop. 750,000). This goal was achieved by training selected elementary school teachers who then served as team leaders in training their peers in microcomputer use. The course included summer session (June 22, 1981 to July 10, 1981) and two follow-up sessions (November 14, 1981 and March 13, 1982). The summer session was composed of lectures and labs with the University's microcomputer resource center open in the evening and available for participant use during the sessions and between sessions. All sessions were held at the University of Wisconsin, Oshkosh campus.

The core of the course was to introduce the participants to the BASIC language and microcomputers. The participants then were given the option of selecting additional instruction in one of the following: using microcomputers to demonstrate mathematical and scientific phenomenon by graphical representations, or using microcomputers to create instructional units in elementary mathematics and science. The lab sessions were devoted to learning how to use microcomputers with "hands-on" experience. The summer session also included guest lectures by individuals involved in computer applications. The post-sessions were devoted to follow-up instruction and discussions of the participants' projects. These also provided the teachers further opportunity to use the microcomputers at UW-Oshkosh. Between the sessions, the project staff visited each participant's school to help introduce microcomputers into the participant's teaching, to help the participant plan and hold peer development sessions, and to discuss the participant's projects.

To be admitted, the applicant was required to have taught for at least two years, to be currently teaching mathematics or science in grades 1-5 in the Oshkosh area, and to demonstrate an interest in using microcomputers in her/his teaching. The course could be taken for 3 credits of graduate or undergraduate credit or CEU units, depending on the participant's interest and status at the University.

Funding Year: 1981
Grant Amount: $37,351
Discipline: Computer Sciences

Workshops on Ecology and Environmental Education

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This modified academic year project provided instruction for fifty-four (54) central Wisconsin teachers of grades K-4 in ecological foundations, the application of ecological foundations to environmental problems, and strategies for inventorying and utilizing ecological resources. The program received nearly 200 applications for the 50 slots. In addition, the project resulted in the dissemination of a manual of regional ecological resources (produced in a previous NSF Pre-College Teacher Development in Science project) during inservice workshops conducted by participating teachers at their schools for colleauges not involved in the current PCTDS project.

Project goals were determined by a Teacher Advisory Committee on the basis of two complex and comprehensive needs assessments conducted by the Central Wisconsin Environmental Station at the University of Wisconsin - Stevens Point and a Science Subject Matter Needs Assessment for Teachers. In order to meet the goals of this project, instruction took place both bi-monthly (two nights for 2 1/2 hours) and on predetermined weekends.

Of considerable interest in this proposal was the multiplier component which enabled both staff and institute participants to provide inservice workshops for an additional 500 teachers.

Instructional strategies used in this institute included classroom instruction combined with laboratory and field work. Four superordinate goals were identified for this project. They are:

1. . . . to train elementary school science teachers in basic ecological concepts and provide allied laboratory experience.

2. . . . to train elementary teachers in the identification and assessment of regional ecological resources which are available for use in both science and environmental education programs.

3. . . . to coordinate the dissemination of the Central Wisconsin Environmental Education Resource Manual which identifies, describes, and points to the educational implications of regional ecological resources.

4. . . . to plan for a major multiplier component during which participants and staff provide inservice workshops for an additional 500 teachers in the use of the resource manual and the resources identified therein.

Funding Year: 1981
Grant Amount: $38,681
Discipline: Ecology

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